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A revision of Thai Agathidinae (Hymenoptera, Braconidae), with descriptions of six new species

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Abstract

The Thai fauna of eleven agathidine genera, i.e., *Biroia, Braunsia, Camptothlipsis, Coccygidium, Cremnops, Cremnoptoides*, *Disophrys, Earinus, Gyrochus, Lytopylus,* and *Troticus,* are revised. 25 species are treated, 20 of which are found in Thailand and five that are likely to occur there. Six new species are described, i.e., *Braunsia chaweewanae* Sharkey, **sp. n.**, *Camptothlipsis annemariae* Sharkey, **sp. n.**, *Camptothlipsis sheilae* Sharkey, **sp. n.**, *Coccygidium mastigion* Sharkey, **sp. n.**, *Coccygidium phaeoscapos* Sharkey, **sp. n.**, and *Cremnoptoides yui* Sharkey, **sp. n.** The following new synonomies are proposed: *Isopronotum seminigripenne* Enderlein, 1920, *Isopronotum tricolor* Enderlein, 1920, *Biroia soror* van Achterberg & Long, 2010, are all synonymized with *Biroia fuscicornis* (Cameron, 1903). *Braunsia pumatica* van Achterberg & Long 2010 is synonymized with *B. fumipennis* (Cameron, 1899). *Braunsia devriesi* van Achterberg & Long 2010 is synonymized with *B. smithii* (Dalla Torre, 1898). *Cremnops malayensis* Bhat, 1979 and *Agathis nigritarsus* Cameron 1899 are synonymized with *C. desertor* (Linnaeus, 1758). *Disophrys macilifera* van Achterberg & Long 2010 is synonymized with *Disophrys strigata* Enderlein, 1920. *Disophrys quymanhi* van Achterberg & Long 2010 is synonymized with *Disophrys subfaciata* (Brullé, 1846). *Agathis burmensis* Bhat & Gupta (1977) is synonymized with *Lytopylus ebulus* (Nixon, 1950). *Disophrys ornatipennis* Cameron 1905 is transferred to *Gyrochus ornatipennis* Cameron, 1905, **comb. n.** *Agathis flavipennis* Brullé is transferred to *Gyrochus flavipennis* (Brullé, 1846), **comb. n.** A key to the genera of Thai Agathidinae and keys to the species of each genus with multiple species are presented.

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Keywords
Thailand, parasitoid wasp, *Agathidinae,* taxonomy, systematics

Introduction

This is the first in a series of papers revising the agathidine braconids of Thailand. Here we treat species of the genera *Biroia, Braunsia, Camptothlipsis, Coccygidium, Cremnops, Cremnoptoides, Disophrys, Earinus, Gyrochus, Lytopylus,* and *Troticus*. The genera *Aneurobracon, Bassus, Euagathis, Therophilus* and *Zelodia* will be dealt with in subsequent publications. Twenty five species are treated here, twenty of which are found in Thailand and five of which have a high probability of being discovered in Thailand.

During the three year period 2006–2009, an intensive survey of the terrestrial arthropod fauna of Thailand was conducted through a collaborative effort among staff at Queen Sirikit Botanic Garden, The Thai Forestry Group, The Hymenoptera Institute and The Natural History Museum of Los Angeles County. This resulted in collecting at about 30 different parks and 559 different sites (Fig. 1). An electronic version of this map is available at the URL below figure 1. Malaise traps were the primary means of collecting, although pan traps and litter samples were also taken. The latter two methods did not result in any specimens of Agathidinae. Figure 1 shows the localities, mostly national parks, where intensive collecting was conducted with Malaise traps. The southern-most states of Thailand were not sampled due to political unrest in the area. For this reason we have included some agathidine species collected in Peninsular Malaysia, with the thought that they may occur in southern Thailand. Users of the species-level keys in this publication are encouraged to check the van Achterberg and Long (2010) treatment of Vietnamese Agathidinae, especially if their specimens do not match well with the figures and descriptions provided here.

Methods

Species limits were ascertained using standard morphological characters and in several cases with the aid of 28S rDNA sequence data. We obtained 28S sequence data from a total of 41 specimens comprising 18 species. The reasons for the choice of specimens were several. 1. Some of the more variable species, based on morphology, were sampled to ensure that they were homogeneous for sequence data. For example, there was one particularly small specimen of what we thought to be *Cremnops desertor*. To check this hypothesis we compared the 28S data of this and a specimen of normal size. 2. Some of the species delimited on morphological grounds appeared to be separated on trivial morphological characters. For example the three species of *Coccygidium* treated here appeared to be different in general gestalt, but specific morphological differences were few and mostly based on color. Therefore this genus was rather heavily sampled, and our preliminary species definitions were corroborated, i.e., each of our morphological species was also distinguishable using 28S data, and every specimen of each species was identical. 3. In one case, *Biroia*

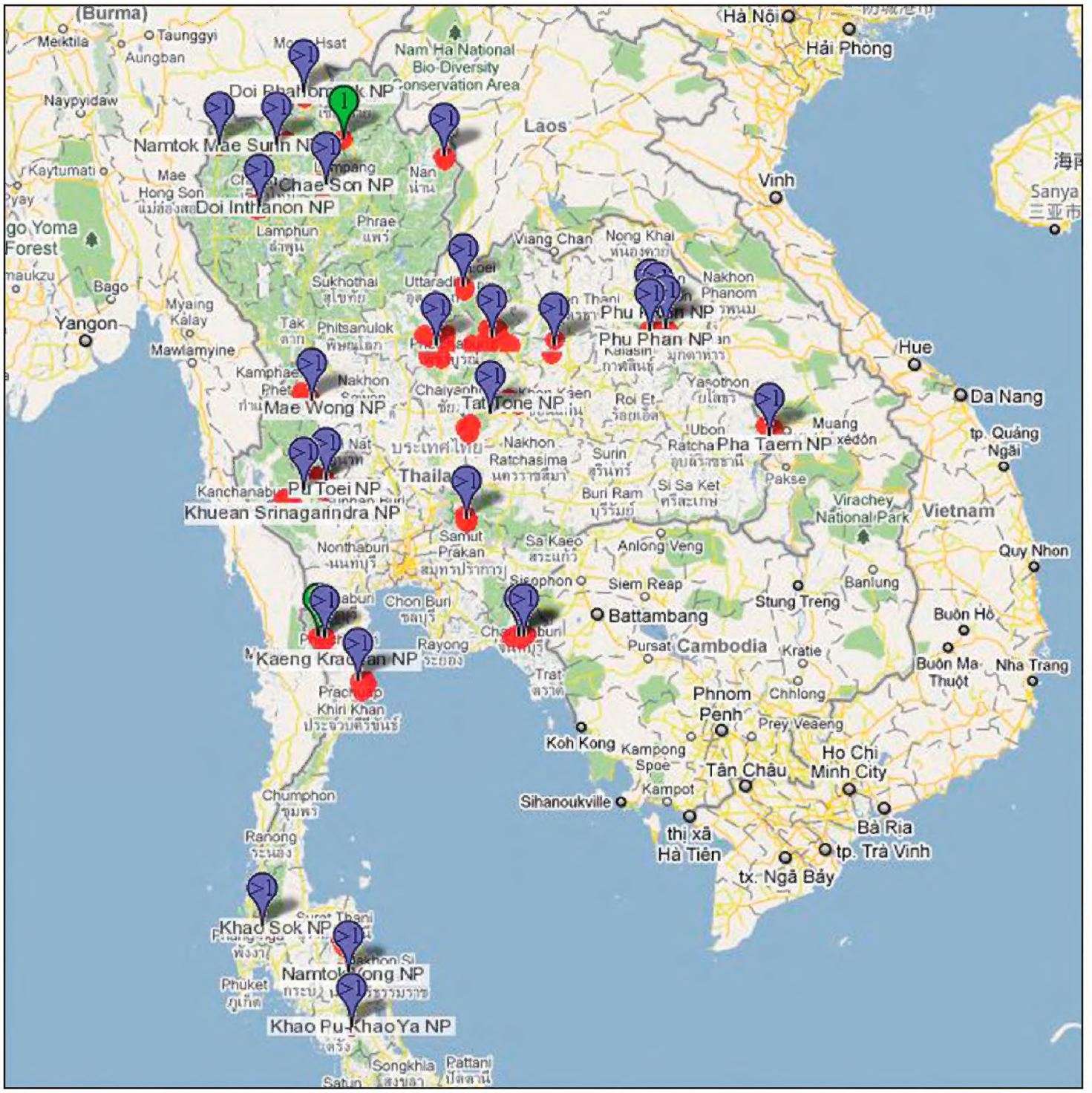


Figure 1. Map showing collection sites in Thailand (Distribution map can be found on http://purl.org/thaimaps/all.

fuscicornis, there are two rather distinct color forms, but otherwise no apparent morphological differences. Because the 28S data are identical between the two color morphs we decided that these represented color variation rather than separate species. 4. In one other case, *Cremnops desertor*, we tested the hypothesis that the Thai specimens were conspecific with those from Europe. Using a specimen from Sweden, the Thai and Swedish specimens differed in one base pair, thus corroborating our hypothesis. We used no magic numbers to determine species limits based on the 28S data. Some species showed some intraspecific variation, e.g., *Camptothlipsis nigra* (Fig. 2) whereas other species differed very little in 28S sequence data but were very distinct morphologically, e.g., *Braunsia chaweewanae* and *B. smithii* (Fig. 2). The sequence data are summarized in a phylogenetic tree in figure 2.

Regions D2-D3 of 28S rDNA (roughly 600 base pairs) were sequenced using the following primers: 28SD2hymF 5' - AGAGAGAGTTCAAGAGTACGTG - 3'

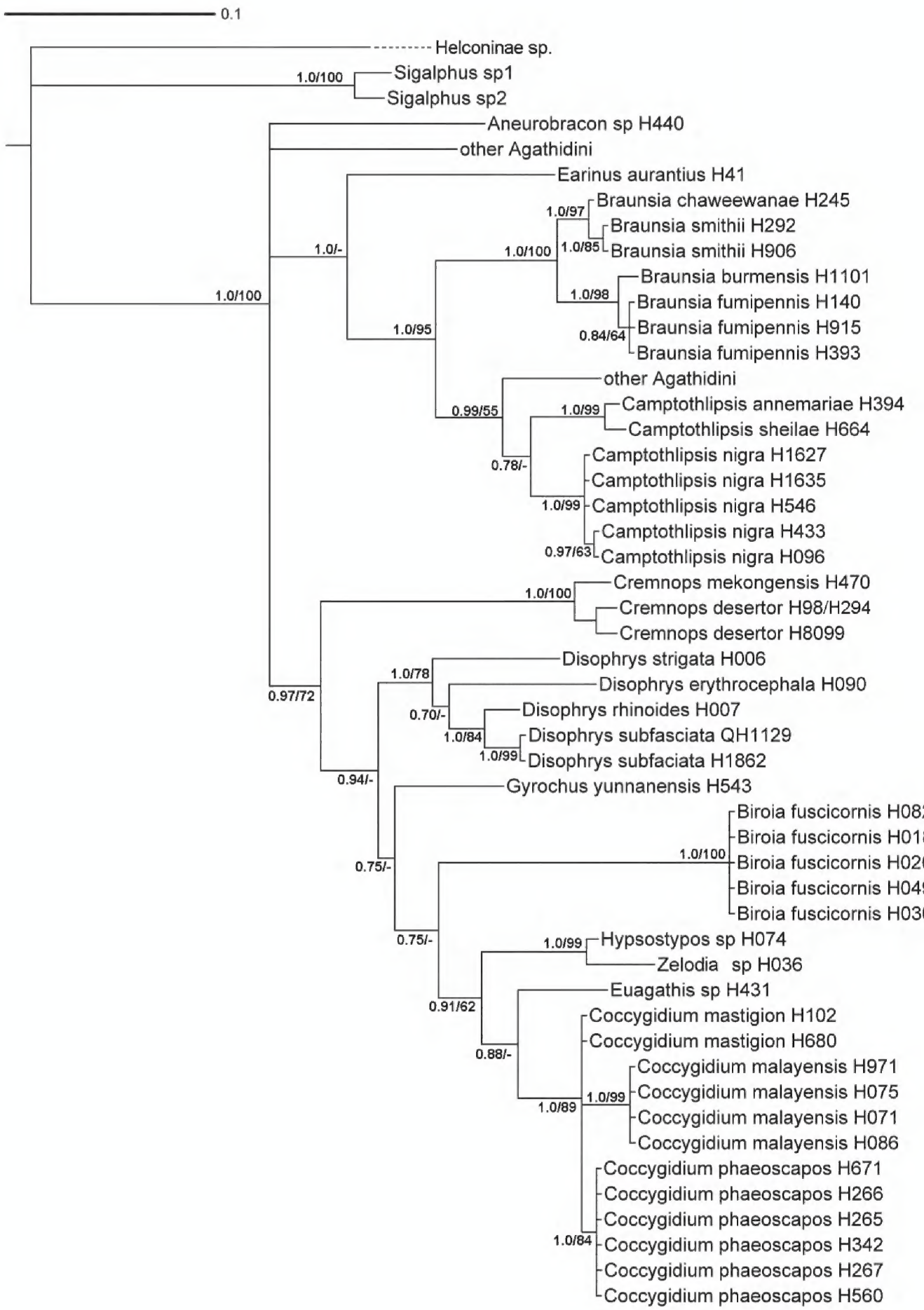


Figure 2. Bayesian phylogram inferred from 28S (region D2-D3) sequence data aligned by secondary structure. Bayesian analysis runtime = 736,000 generations (25% burnin). Branch support: Bayesian posterior probabilities / bootstrap (1,000 replicates). **(-)** indicates bootstrap support below 60.

and 28SD3hymR 5' - TAGTTCACCATCTTTCGGGTC - 3'. Sequences were edited using Geneious Pro v4.7.5 (Drummond et al. 2009) and aligned based on a secondary structure model for Ichneumonoidea developed by Yoder and Gillespie (2004)

and Gillespie et al. (2005). Regions of expansion and contraction (RECs), regions of slipped-strand compensation (RSCs), and short regions of alignment ambiguity were further aligned/corrected by eye. Three of these regions (28 base pairs total) were deleted because they could not be aligned with any confidence, i.e., there were multiple equally supported alignment options. All sequences have been deposited in GenBank and TreeBase (a nexus file can be downloaded at www.treebase.org).

Phylogenetic trees were constructed using maximum parsimony (MP) and Bayesian methods. MP was performed using TNT (Goloboff et al. 2008). A traditional search with 100 random addition sequences followed by branch-swapping, saving 10 trees per replication, was performed. 1000 bootstrap replications were used to estimate branch reliability. The Bayesian analysis was performed using MrBayes v3.1.2 (Ronquist and Huelsenbeck 2003). A best-fitting DNA substitution model was determined using MrModeltest2.2 (Nylander 2004). The general time reversible model of evolution with a parameter for invariant sites and rate heterogeneity modeled under a gamma distribution (GTR+I+G) was determined as the best-fitting model. Each Bayesian analysis consisted of two independent Bayesian MCMC runs initiated from different random starting trees. The analysis ran for 736,000 generations, reaching a topological similarity criterion of 0.01; trees were sampled every 500 generations. 25% of the trees from each run were removed as burn-in upon topological convergence. The tree in figure 2 is that produced by the Bayesian analysis. The support values on the branches are posterior probabilities and where the same clade was present in the MP result a bootstrap value is given. The purpose of the phylogenetic tree is to show distances between, and support for, the species concepts rather than to show relationships among higher taxa. A far larger data set is necessary for the latter and some of the higher relationships shown in figure 2 are contradicted by more thorough analyses, e.g., Sharkey et al. (2006).

Source images for the dichotomous key and the interactive key are in Appendices 1 and 2. Keys were generated using DELTA Editor Dallwitz et al. (1999), DELTA Dallwitz et al. (1993), and Intkey Dallwitz et al. (1995).

Morphological terms follow Sharkey and Wharton (1997) except for the following:

OOL = ocellar ocular length; LOD = lateral ocellar diameter; IOL = inter ocellar length; EH = eye height; MS = malar space length. Measurements are given for the length and apical width of the first metasomal median tergite. Measurement of the apical width is straightforward, however since the base of the tergite is usually hidden from view it is difficult to measure the total length. Instead we measure from the apex of the large tendon that emanates from the propodeum and inserts near the base of the median tergite. Both measurements are illustrated in figure 27.

All 25 species are treated with a diagnosis and distribution data. In a few instances a short description is also given for previously described species. The six new species are described with little text; however they, and most previously described species, are comprehensively illustrated with color photos using a JVC digital camera mounted on a Leica MZ16 microscope and Automontage® stacking software. Written descriptions of color patterns are considered redundant due to the completeness of the color illustrations, however when color variation occurs within a species this is referred to in the text, if it is not illustrated. It has been common practice to carefully describe coloration but in our view this is

a hold-over from the past when extensive color images were impractical or impossible. The color information is much more accurately recovered from the color photos. Tedious measurements and details of sculpture are not included unless they are of diagnostic value. It is difficult to predict which of the hundreds of possible characters are worth describing and this is rather dependent on the discovery of new species that may be similar to some of those described here. However since all body parts are extensively illustrated and if, for example, the sculpture of the metapleuron or the length of the malar space is important to distinguish a new species, this information is contained in the illustrations. Distribution data are listed for all new species and a Google map via Berkeley Mapper is included for all species.

Distribution data, pdf's of non-copywrite references, images, notes, and host and type information can be found by searching TaxaBank (a combined specimen and taxonomic database developed by Dr. Dicky Yu in the Sharkey lab; http://purl.org/taxabank) using the specimen voucher H number.

Abbreviations. Abbreviations used for institutions for where specimens are deposited are as follows:

AEI	American Entomological Institute, Gainesville, Florida, USA.
BMNH	Natural History Museum, London, England.
CNC	Canadian National Collection of Insects, Ottawa, Ontario, Canada.
FSCA	Florida State Collection of Arthropods, Gainesville, Florida, USA.
HIC	Hymenoptera Institute Collection, University of Kentucky, Department of Entomology, Lexington, Kentucky, USA.
HNHM	Hungarian Natural History Museum, Budapest, Hungary.
IZCAS	Chinese Academy of Sciences, Institute of Zoology, Beijing, China.
MNHN	Museum National d'Histoire Naturelle, Paris, France.
MZPW	Polish Academy of Science, Museum of the Institute of Zoology, Warsaw, Poland.
NHRS	Naturhistoriska riksmuseet, Stockholm, Sweden.
OUMNH	University Museum of Natural History, Oxford, United Kingdom QSBG Queen Sirikit Botanic Garden, Chaing Mai. Thailand.
RMNH	NCB Naturalis Collection [formerly Rijksmuseum van Natuurlijke Historie], Leiden, Netherlands.
UKM	Universiti Kebangsaan, Bangi, Selangor, Malaysia.
USNM	National Museum of Natural History, Smithsonian Institution, Washington DC, USA.

Taxonomy

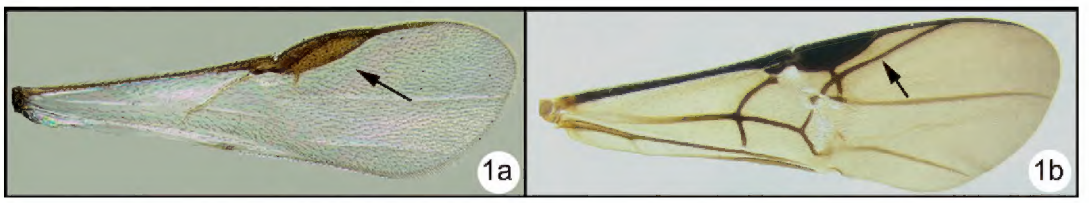
Key to Thai genera of Agathidinae

The key of Sharkey et al. (2009) is modified to allow *Gyrochus* to be properly identified and to include the genus name *Zelodia* for *Amputostypos*, which is a junior synonym of

Coccygidium as demonstrated by van Achterberg and Long (2010). An interactive key built on Delta and Intkey software is included in the appendix along with all supporting data and images.

1 Fore wing venation greatly reduced, last abscissa (segment) of RS vein completely absent (1a) ..... ***Aneurobracon* Brues, 1930**

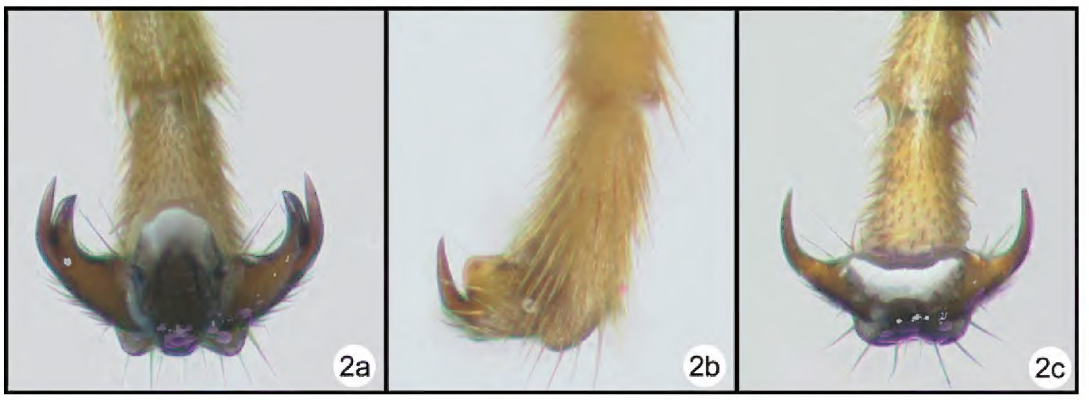
– Fore wing venation more complete, last abscissa of RS vein present though sometimes weak (1b) **2**



2(1) Fore and mid claws cleft (2a) **3**

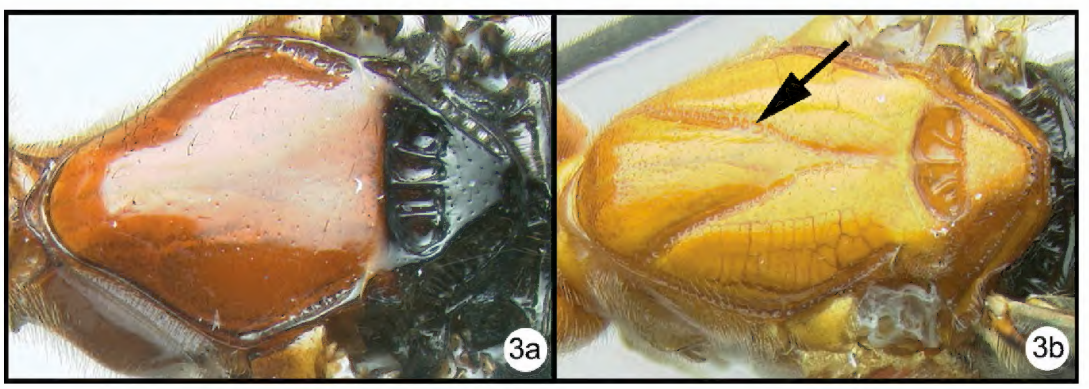
– Fore and mid claws with a basal lobe (2b) **12**

– Fore and mid claws simple (2c) ..... ***Bassus* Fabricius, 1804**



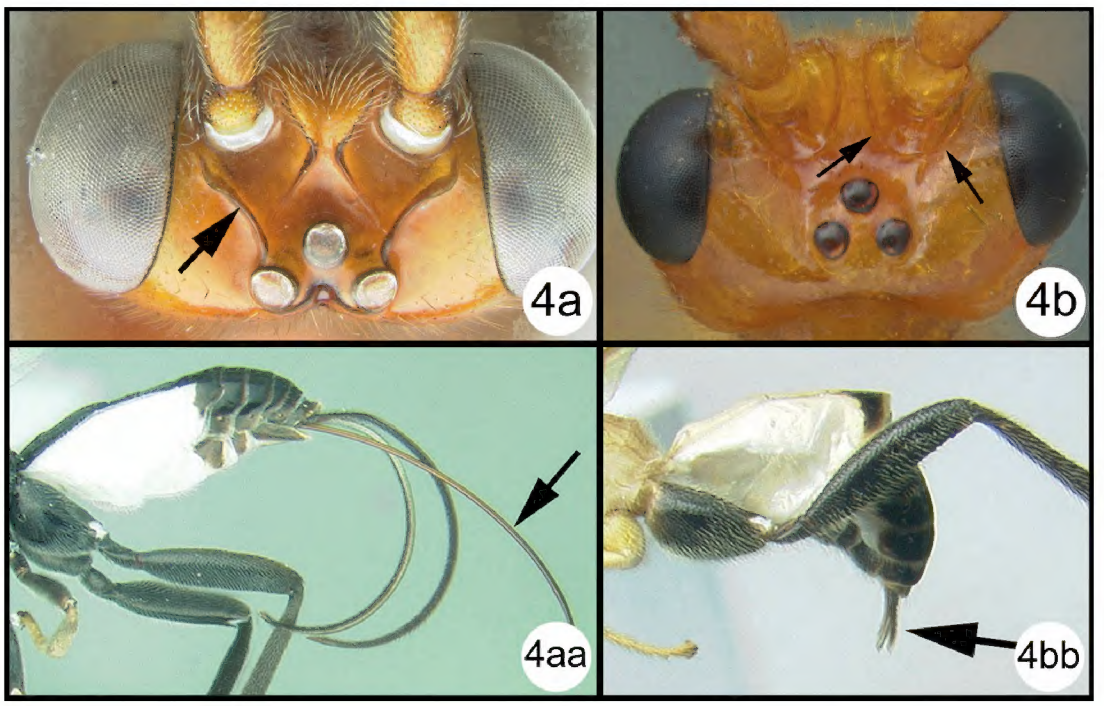
3(2) Notauli absent (3a) **4**

– Notauli present but not necessarily complete (3b) **5**



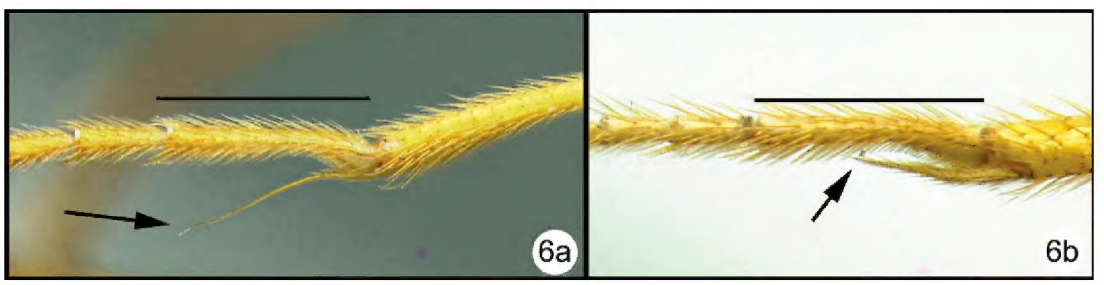
4(3) Lateral carina of frons directed towards lateral ocellus and not fused with medial carina (4a); ovipositor at least as long as metasoma (as in 4aa) ..... ***Biroia* Szépligeti, 1900**

– Lateral carina of frons fused with medial carina forming a circular border around antennal base (4b); ovipositor barely exerted (as in 4bb) ..... ***Gyrochus* Enderlein, 1920**

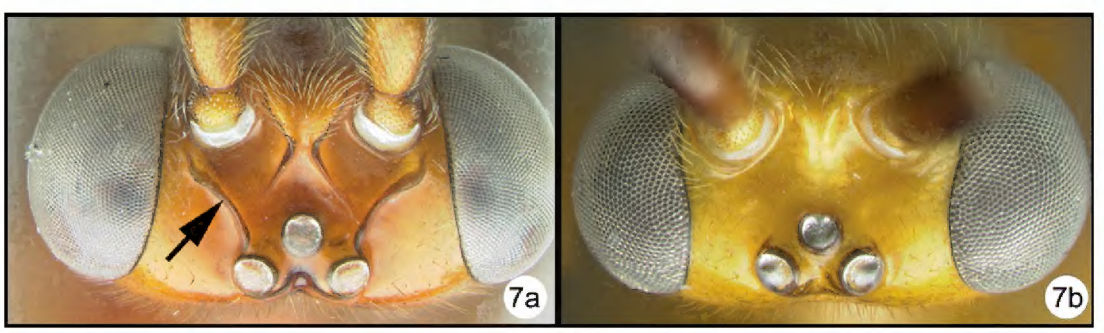


5(3) Hind trochantellus with one or two distinct carinae (5a) **6**
– Hind trochantellus lacking carinae (5b) **9**

6(5) Fore tibial spurs about as long as basitarsus and ending in a long thin style (6a) ..... ***Coccygidium*** **Saussure, 1892**
– Fore tibial spurs less that 3/4 length of fore basitarsus and ending abruptly (6b) 7

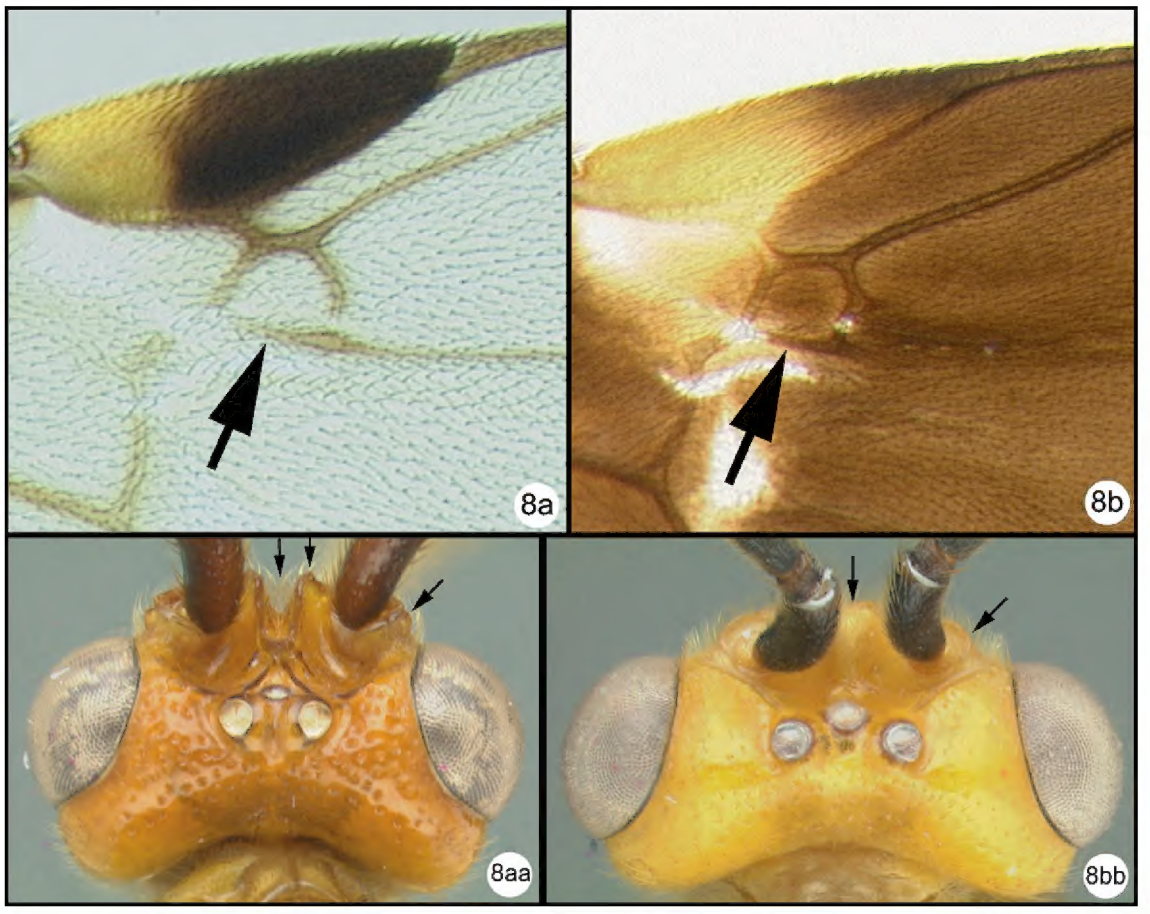


7(6) Posterolateral margins of frons bordered with carinae (7a) **8**
– Posterolateral margins of frons not bordered with carinae (7b)..... ..... ***Zelodia van*** **Achterberg & Long, 2010**



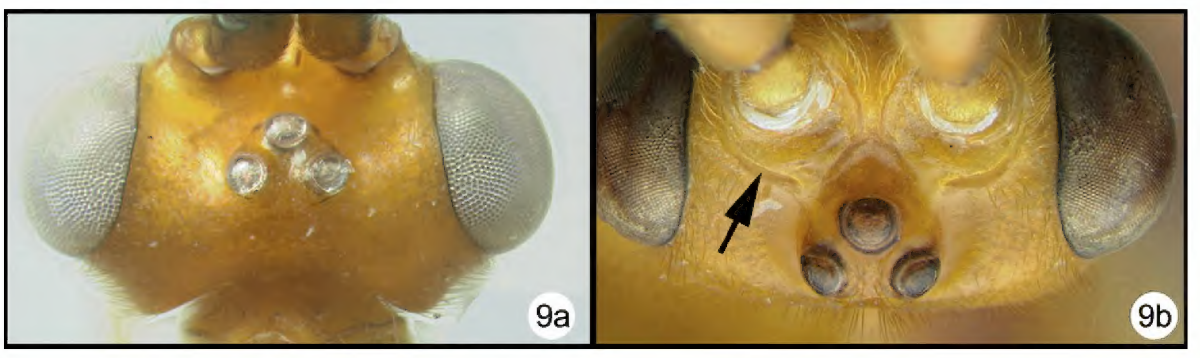
8(7) 2nd submarginal cell of fore wing triangular or distinctly narrowing anteriorly (8a); base of antenna surrounded by pronounced medial, lateral, and anterior ridges; deep groove between antennae (8aa) ..... ***Hypsostypos* Baltazar, 1963***

– 2nd submarginal cell of fore wing quadrate, not distinctly narrowing anteriorly (8b); base of antenna surrounded by weak lateral, and anterior ridges; lacking deep groove between antennae (8bb) ..... ***Cremnoptoides* van Achterberg & Chen, 2004**



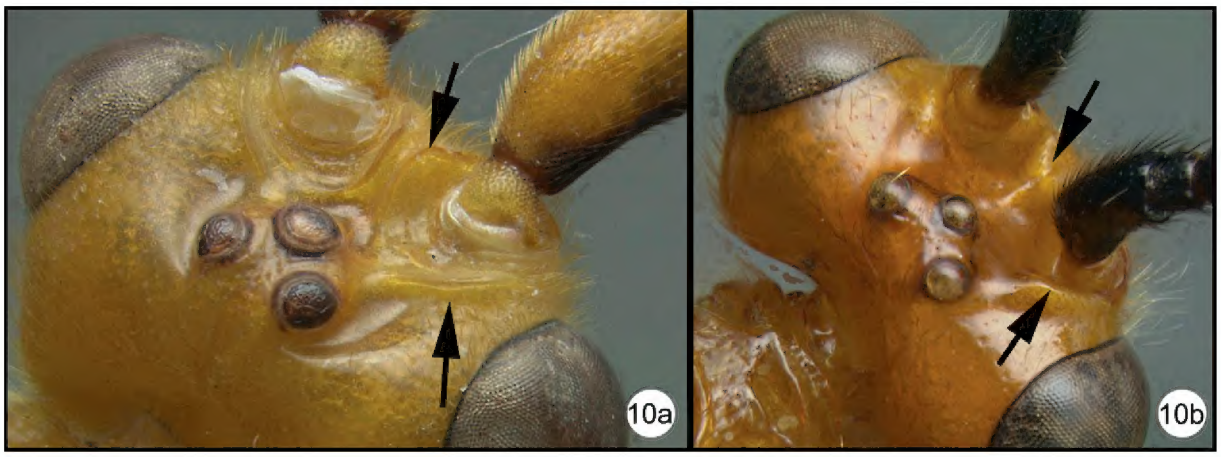
9(5) Posterolateral margins of frons not bordered with carinae (9a) ..... ***Euagathis* Szépligeti, 1900**

– Posterolateral margins of frons bordered with carinae (9b) **10**



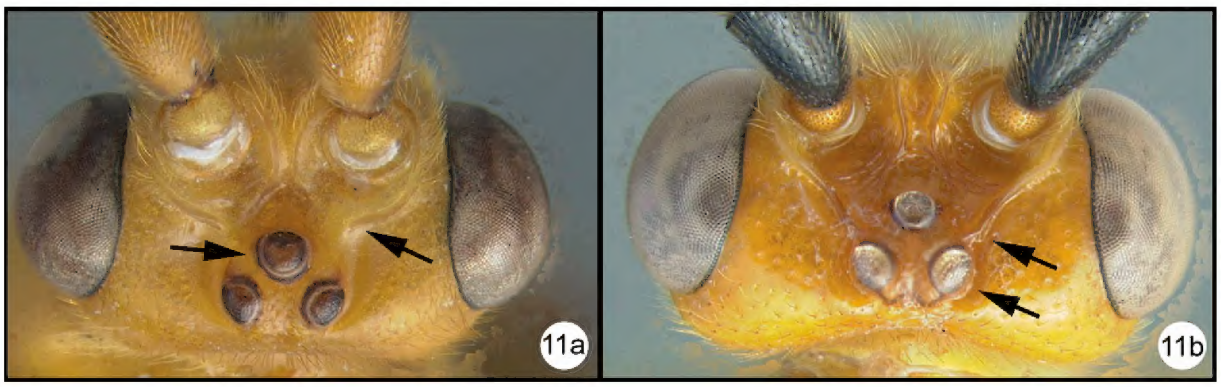
10(9) Medial and lateral carinae of frons lamellate (high and thin) (10a); ovipositor barely exerted, much shorter than half length of metasoma (see 4bb)..... **11**

– Medial and lateral carina of frons in the form of blunt ridges, not lamellate (10b); ovipositor at least as long as the metasoma (see 4aa) ..... ***Cremnops* Förster, 1862**



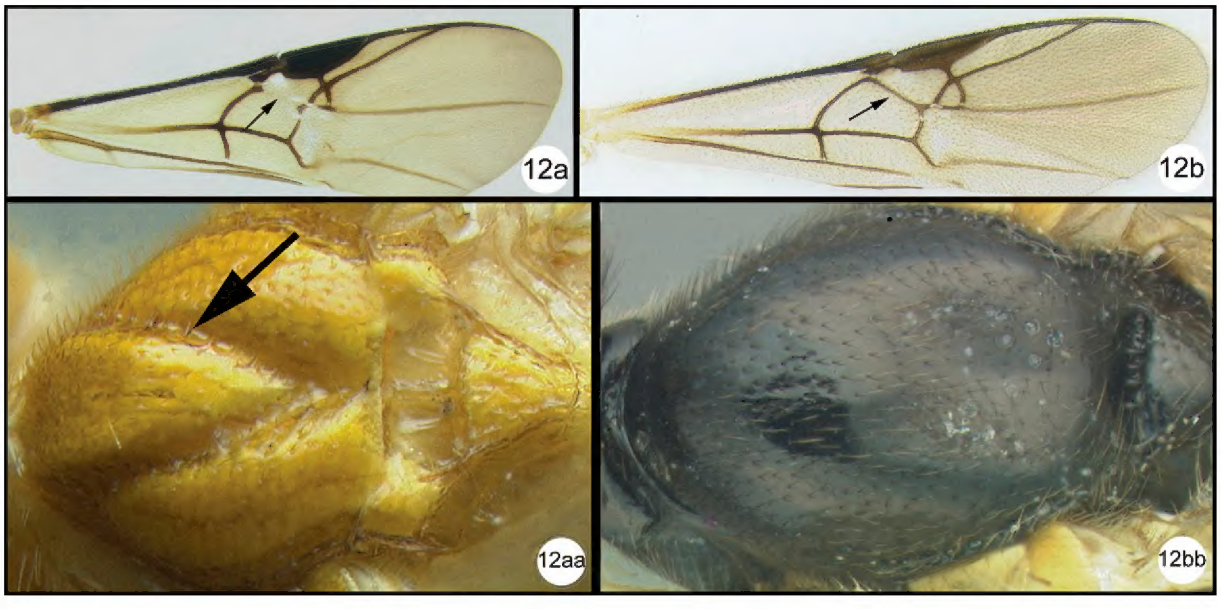
11(10) Lateral carina of frons with posterior ends directed towards median ocellus (11a) ..... ***Troticus*** **Brullé, 1846**

– Lateral carina of frons with posterior ends directed towards lateral ocelli (11b) ..... ***Disophrys*** **Förster, 1862**



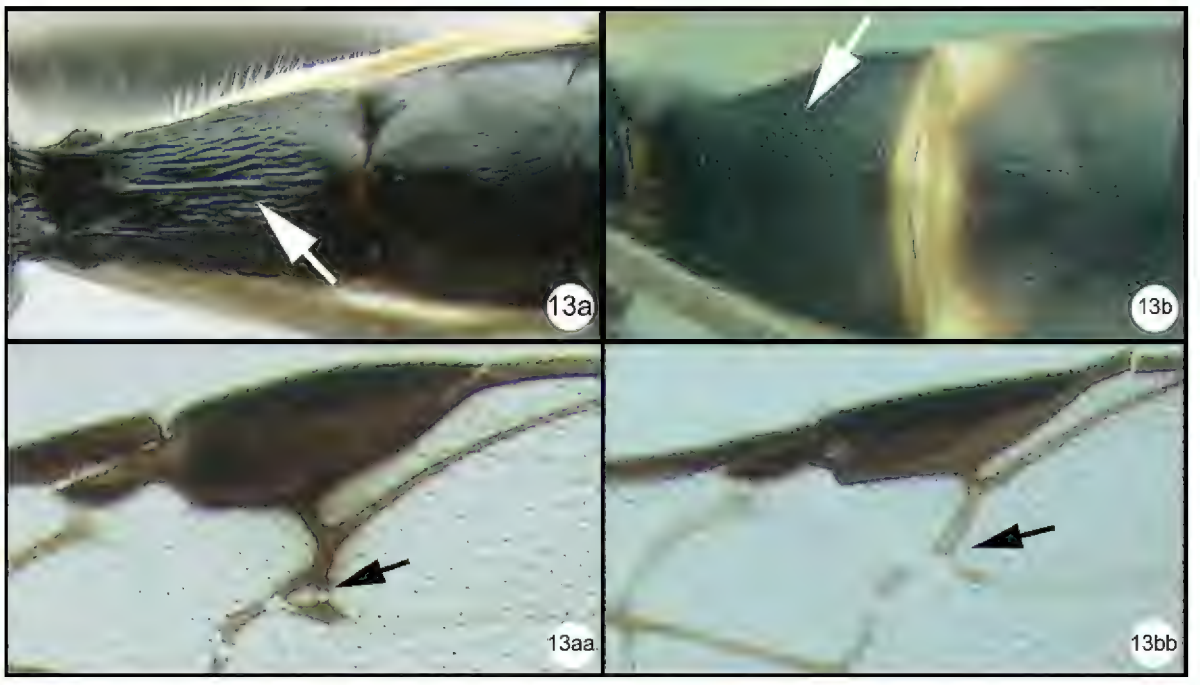
12(2) RS+M vein of fore wing mostly or entirely absent (12a); notauli present but not necessarily complete (12aa) **13**

– RS+M vein of fore wing present and complete (12b); notauli absent (12bb)... ..... ***Earinus*** **Wesmael, 1837**



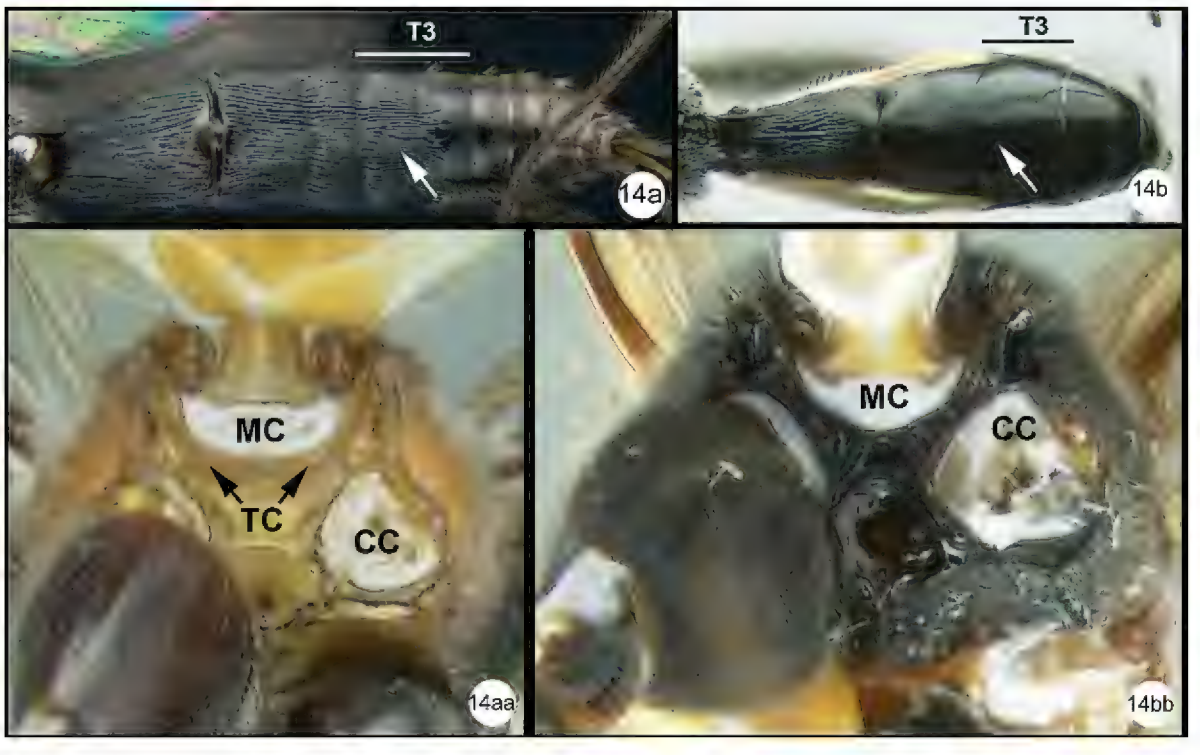
13(12) First median tergite mostly striate (13a) or (rarely) smooth; 2nd submarginal cell of fore wing usually present (13aa) **14**

– First median tergite mostly granulate or coriaceous (13b); 2nd submarginal cell of fore wing absent (13bb) ..... ***Camptothlipsis*** **Enderlein, 1920**



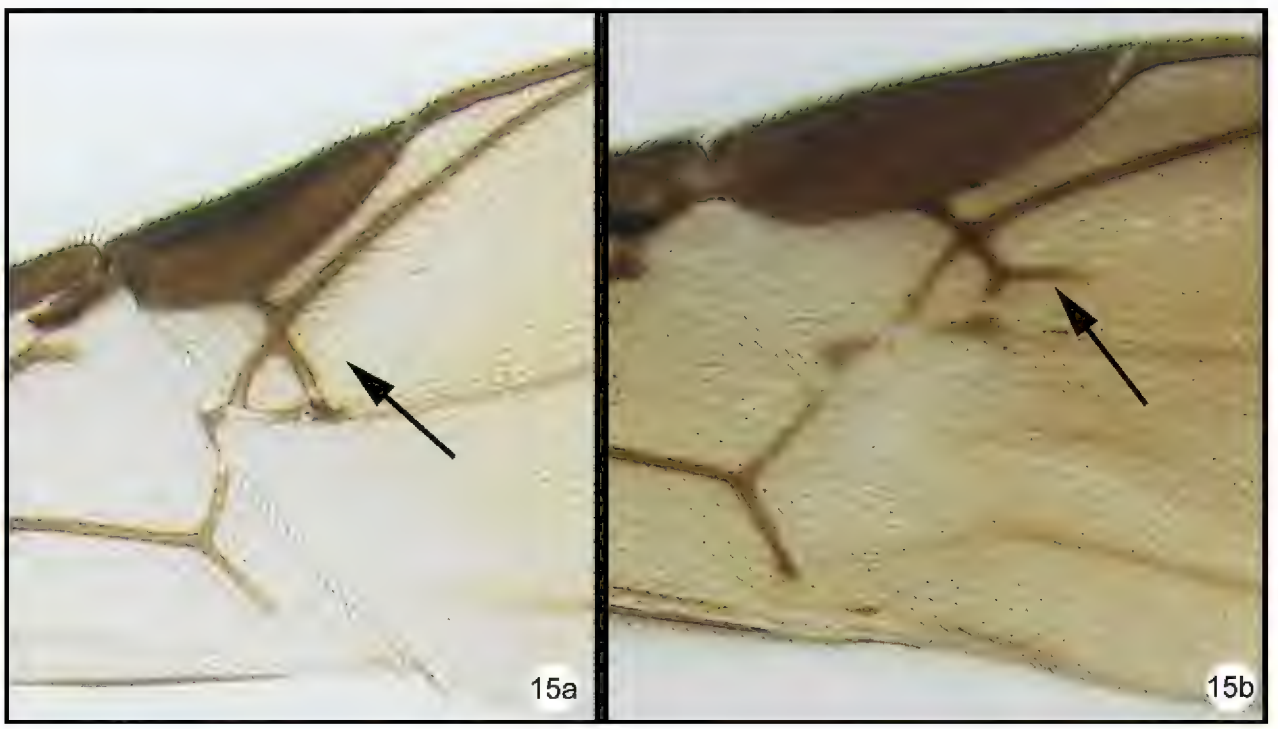
14(13) Median tergite 3 extensively striate in anterior half or more (14a); metasomal cavity (MC) situated entirely dorsal to coxal cavities (CC); a wide, high, straight, transverse carina (TC) present between metasomal cavity (MC) and coxal cavities (CC) (14aa) **15**

– Median tergite 3 smooth (14b); metasomal cavity (MC) situated partly between coxal cavities (CC); wide, high, straight, transverse carina (TC) between metasomal (MC) and coxal cavities absent, usually curved and relatively shallow if present (14bb) **16**



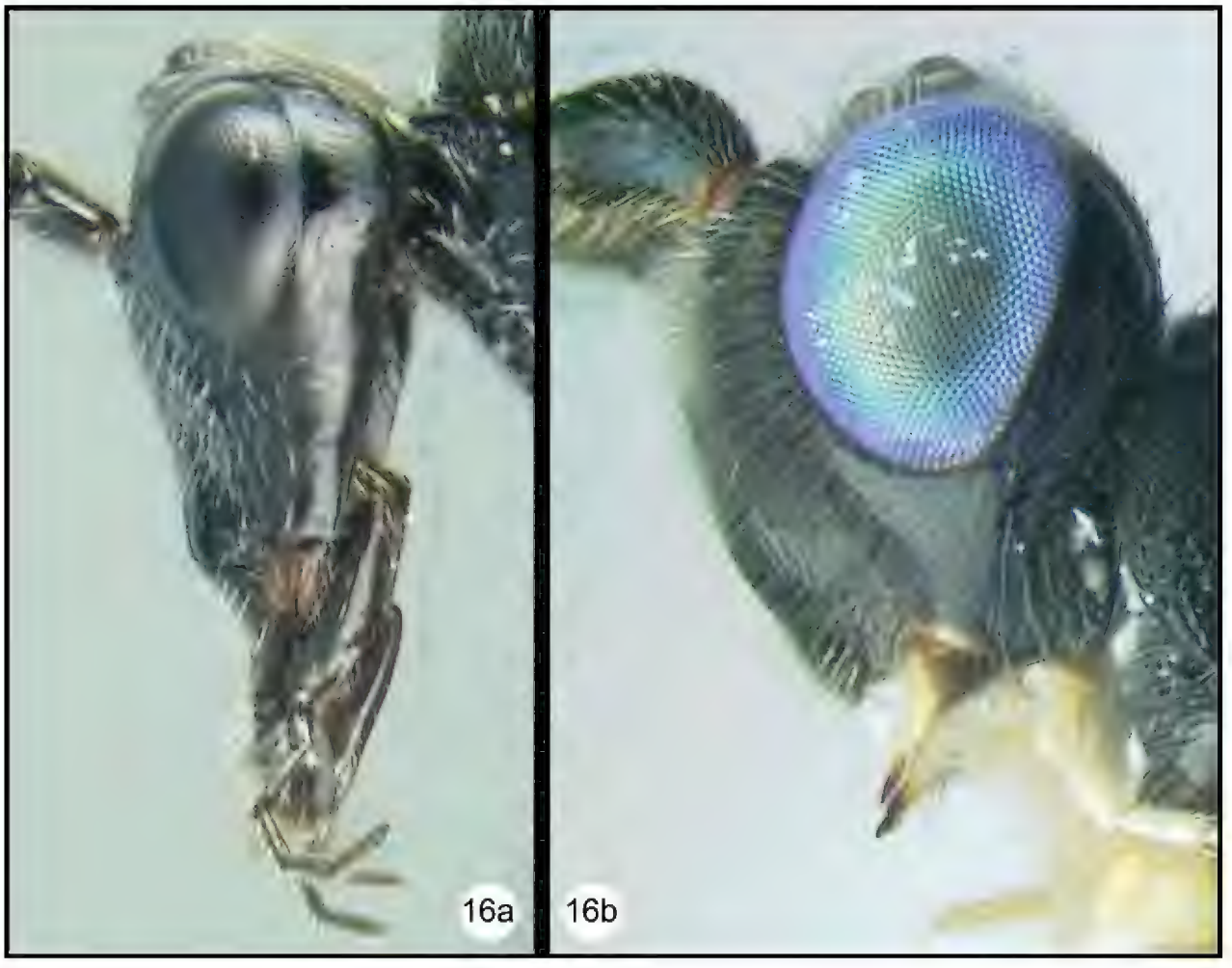
15(14) Adventitious vein (2RS) on r-m crossvein of fore wing absent or indicated only by slight swelling (15a)..... ***Lytopylus*** **Förster, 1862**

– Adventitious vein (2RS) on r-m crossvein of fore wing present and distinct (15b) ..... ***Braunsia*** **Kriechbaumer, 1894**



16(14) Mouthparts long, galea significantly longer than wide; gena usually elongate (16a) .....
...***Agathis*** **Latreille, 1804** (not yet discovered in Thailand but likely to occur).

– Mouthparts short (normal), galea not longer than wide; gena not elongate (16b) ..... ***Therophilus*** **Wesmael, 1837**



Systematics

***Biroia fuscicornis* (Cameron)**
http://species-id.net/wiki/Biroia_fuscicornis
Figs 3–5

Disophrys fuscicornis Cameron 1903 [BMNH, examined], Malaysia (Sarawak).
Cremnops satapensis Cameron 1907 [BMNH, examined], Malaysia (Sarawak).
Isopronotum seminigripenne Enderlein 1920, syn. n. [MZPW, examined], Indonesia (Sumatra).
Isopronotum tricolor Enderlein 1920, syn. n. [MZPW, examined], Indonesia (Sumatra).
Biroia soror van Achterberg and Long 2010, syn. n. [RMNH, examined], Vietnam.

Diagnosis. There is only one species of *Biroia* in Thailand though it is extreme in its color variation. The head and pro- and mesothorax vary from entirely black to orange. In Thailand there is little variation between these two extremes, although several of the orange forms have the vertex black. One specimen from Brunei has the head mostly black and the mesoscutum black in the posterior 2/3. The wings are melanic-infuscate basally and milky white distally. 28S sequence data for four specimens of the melanic form and one specimen of the orange and black form are identical (Fig. 2).

Biroia fuscicornis Cameron 1903, *Cremnops satapensis* Cameron 1907, *Isopronotum seminigripenne* Enderlein 1920, *Isopronotum tricolor* Enderlein 1920, and *Biroia soror* van Achterberg and Long 2010 are all considered here as junior synonyms of *Biroia fuscicornis*. The major differences between these nominal species are in coloration and it is noteworthy that all three of the taxa described by Enderlein are from the same locality, Sarawak, and presumably from similar dates. *Biroia abdominalis* (Enderlein 1920) is also very similar and may represent the same species but until sequence data are available we choose to keep it separate, in agreement with van Achterberg and Long (2010).

GenBank accessions. *H0030:* #HQ667945 (black form). *H0018:* #HQ667942. *H0020:* #HQ667943. *H0049:* #HQ667944. *H0082:* #HQ667941

Distribution. Peninsular Malaysia, Borneo (Sarawak, Brunei), Indonesia (Sumatra), Singapore, Thailand, Vietnam. Distribution maps can be found at http://purl.org/thaimaps/bfuscicornis.

Examined specimens are deposited in the following collection: MZPW, BMNH, HIC, USNM, UKM, QSBG, RMNH.

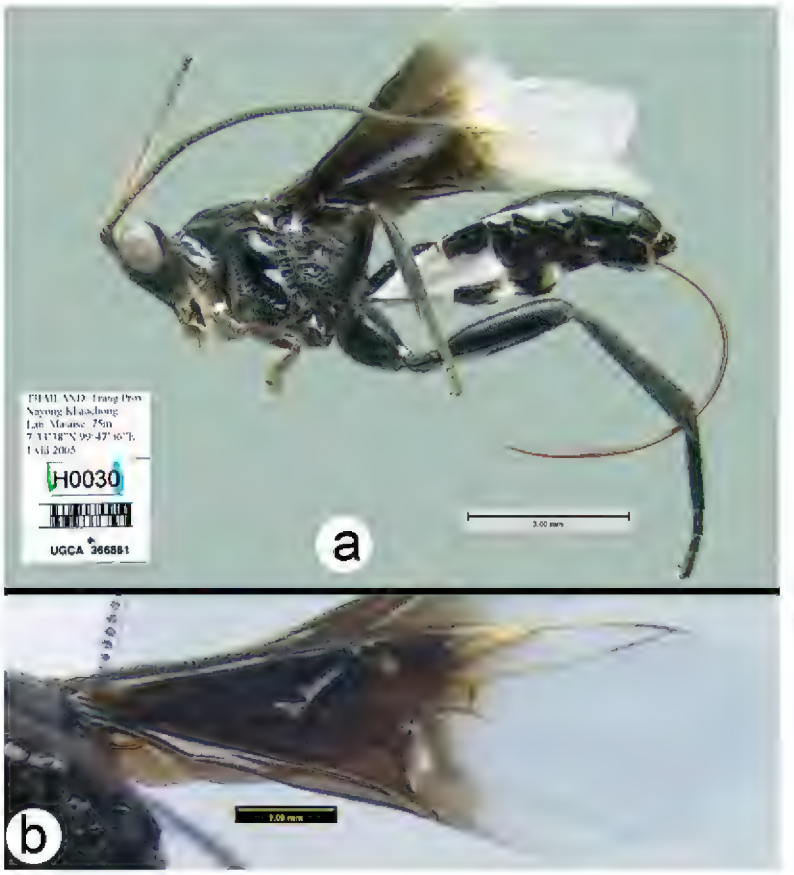


Figure 3. *Biroia fuscicornis* Cameron, dark morph **a** lateral habitus **b** fore wing.

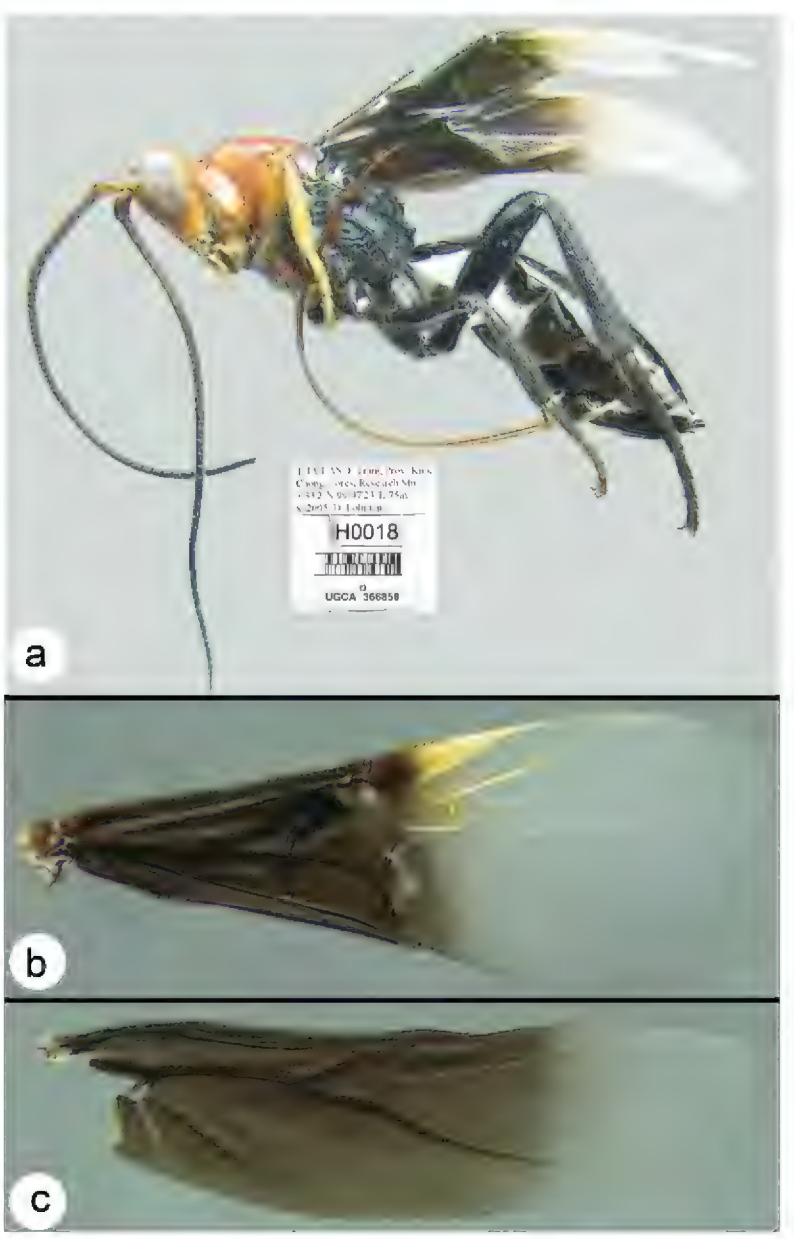


Figure 4. *Biroia fuscicornis* Cameron, light morph **a** lateral habitus **b** fore wing **c** hind wing.

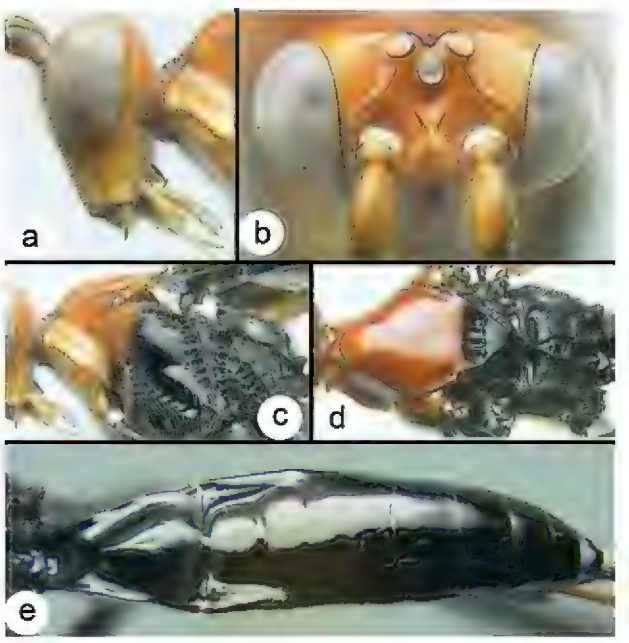


Figure 5. *Biroia fuscicornis* Cameron, light morph **a** lateral head **b** dorsal head **c** lateral mesosoma **d** dorsal mesosoma **e** dorsal metasoma.

Braunsia

Key to Thai species of *Braunsia*

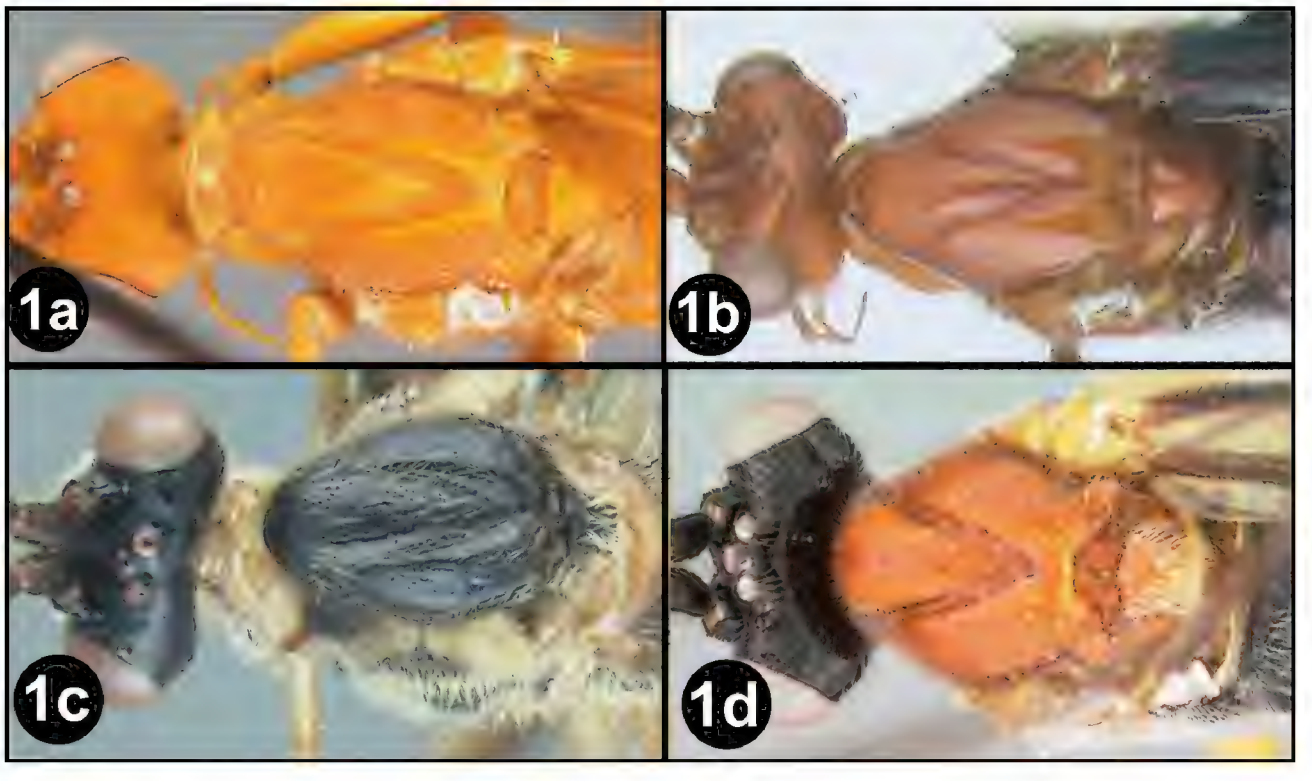
Only two species are known from Thailand; however three species from Peninsular Malaysia are included due to their likelihood of occurring in southern Thailand.

1a Dorsal head and mesoscutum entirely yellow **2**

1b Dorsal head and mesoscutum entirely reddish brown .... ***B. sumatrana* Enderlein**

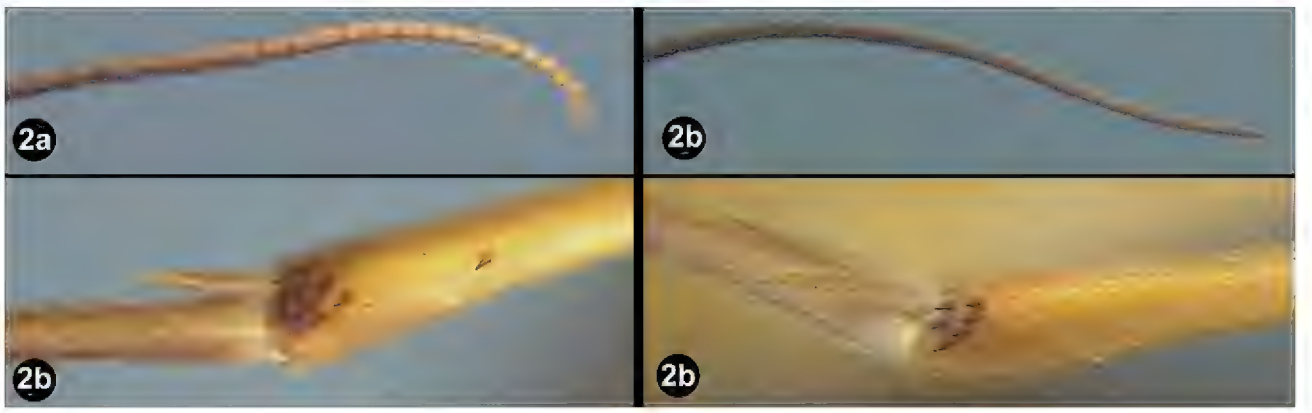
1c Dorsal head black and mesoscutum melanic or mostly melanic **3**

1d Dorsal head black, mesoscutum yellowish orange... ***B. fumipennis* (Cameron)**



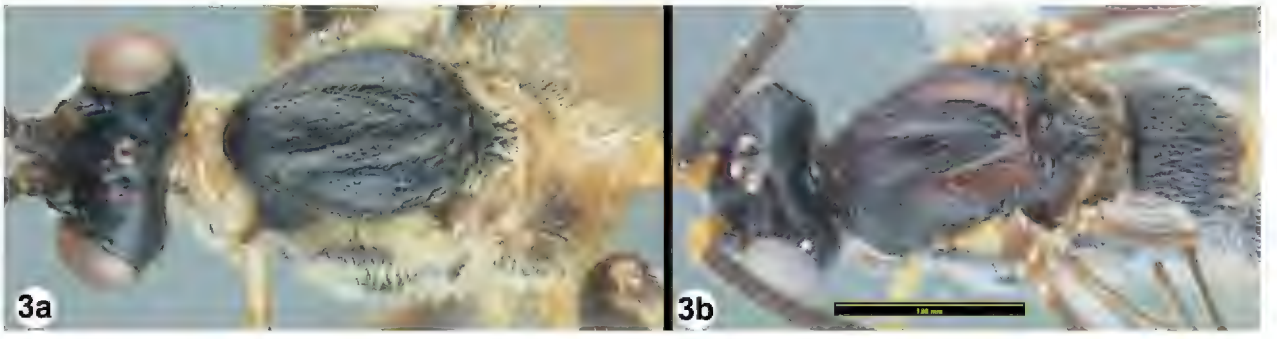
2a Apex of antenna yellow, hind tibia with 13 or more spines.....
.....***B. chaweewanae*** **Sharkey, sp. n.**

2b Apex of antenna melanic, hind tibia with 12 or fewer spines.....
.....***B. smithii*** **Dalla Torre**



3a Mesosoma with many infusions of yellow color especially on pronotum and propodeum.....***B. comosa*** **Enderlein**

3b Mesosoma mostly melanic with the lateral lobes of scutellum sometimes deep reddish black; pronotum and propodeum melanic.....
B. burmensis **Bhat & Gupta**



Braunsia burmensis **Bhat & Gupta**
http://species-id.net/wiki/Braunsia_burmensis
Figs 6

Braunsia burmensis Bhat and Gupta 1977 [NHRS, examined] Myanmar.

Diagnosis. Mesosoma entirely melanic, sometimes with the lateral lobes of the mesoscutum reddish black; wings weakly infuscate; second metasomal median tergite pale in basal half or more.

GenBank accession. *H1101:* #DQ201930

Distribution. Myanmar and Peninsular Malaysia (Cameron Highlands). Specimens are deposited in NHRS (holo- and allotype), and HIC (one specimen). The species is included here due to its likelihood of occurring in Thailand. Distribution maps can be found at http://purl.org/thaimaps/burmensis.

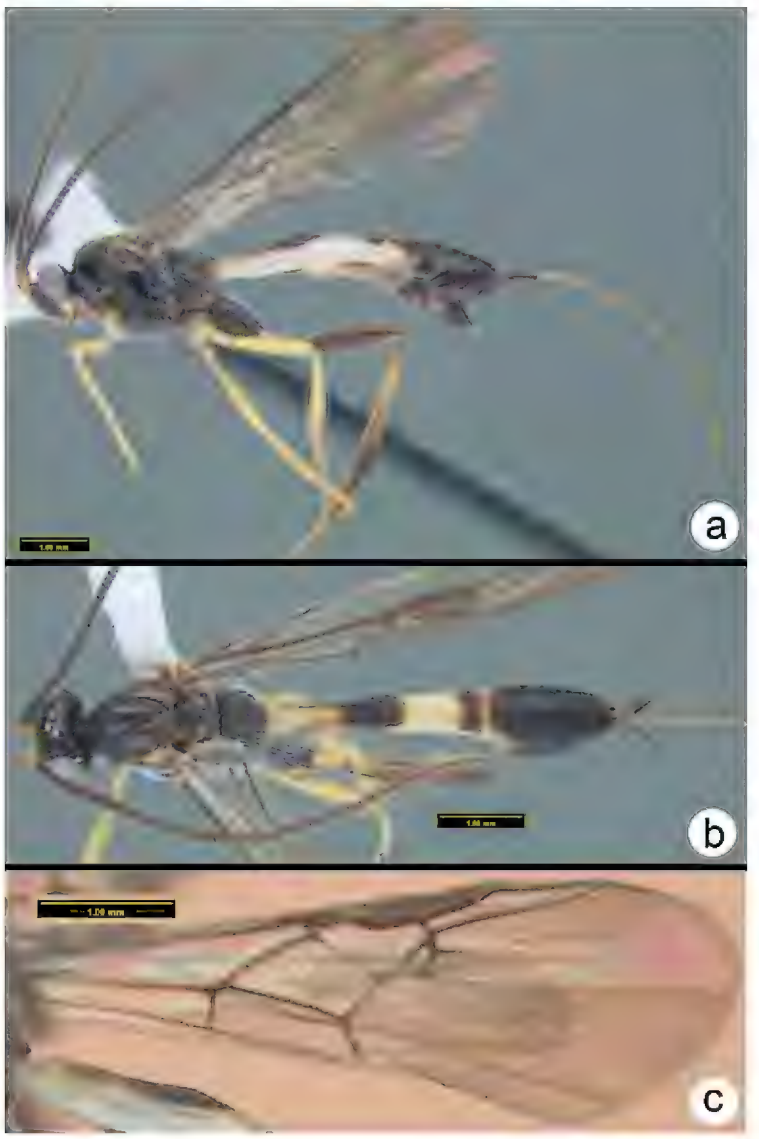


Figure 6. *Braunsia burmensis* Bhat & Gupta **a** lateral habitus **b** dorsal habitus **c** fore wing.

***Braunsia chaweewanae* Sharkey, sp. n.**
urn:lsid:zoobank.org:act:71694C50-E347-46B6-86E4-DDA3FCC668CD
http://species-id.net/wiki/Braunsia_chaweewanae
Figs 7–8

Diagnosis. Differs from *B. smithii* (Dalla Torre 1898) as follows: Apex of antenna yellow; fore wing with a larger melanic parastigmal spot and apex of fore wing darker; mid and hind tibia with more apical spines. The lateral ocelli of *B. chaweewanae* are slightly more than ½ as wide as the distance from the eye to the lateral ocellus, whereas those of *B. smithii* are distinctly less than ½ as wide.

Description. Holotype female. Essentially as in *B. smithii* except as follows:

Body length. 9.5mm.

Head. OOL 0.32; POD 0.13; IOL 0.16; 45 flagellomeres

Mesosoma. tubular portion of 2RS2 of fore wing shorter than length of 2nd submarginal cell; midtibia with 9 (right) to 11 (left) melanic spines; hind tibia with 16 (right) spines.

Metasoma. Median tergite 1 about 1.7X as long as wide apically (length = 1.66mm, width = 1.0mm).

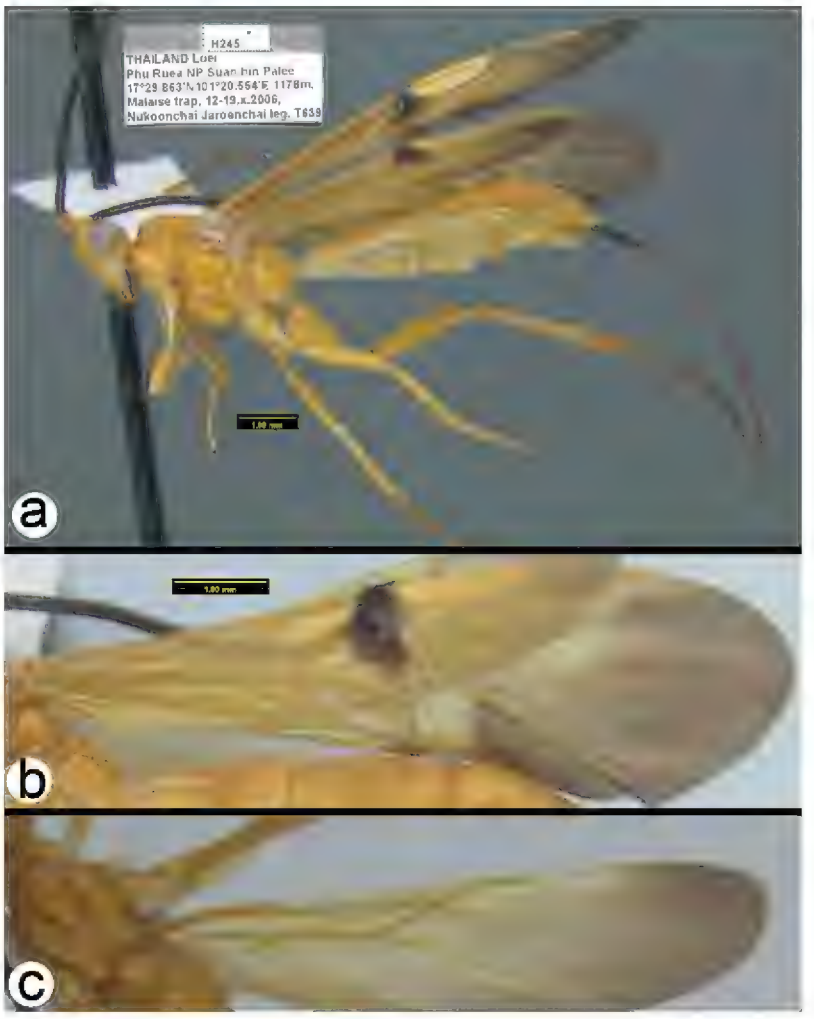


Figure 7. *Braunsia chaweewanae* sp. n. **a** lateral habitus **b** fore wing **c** hind wing.

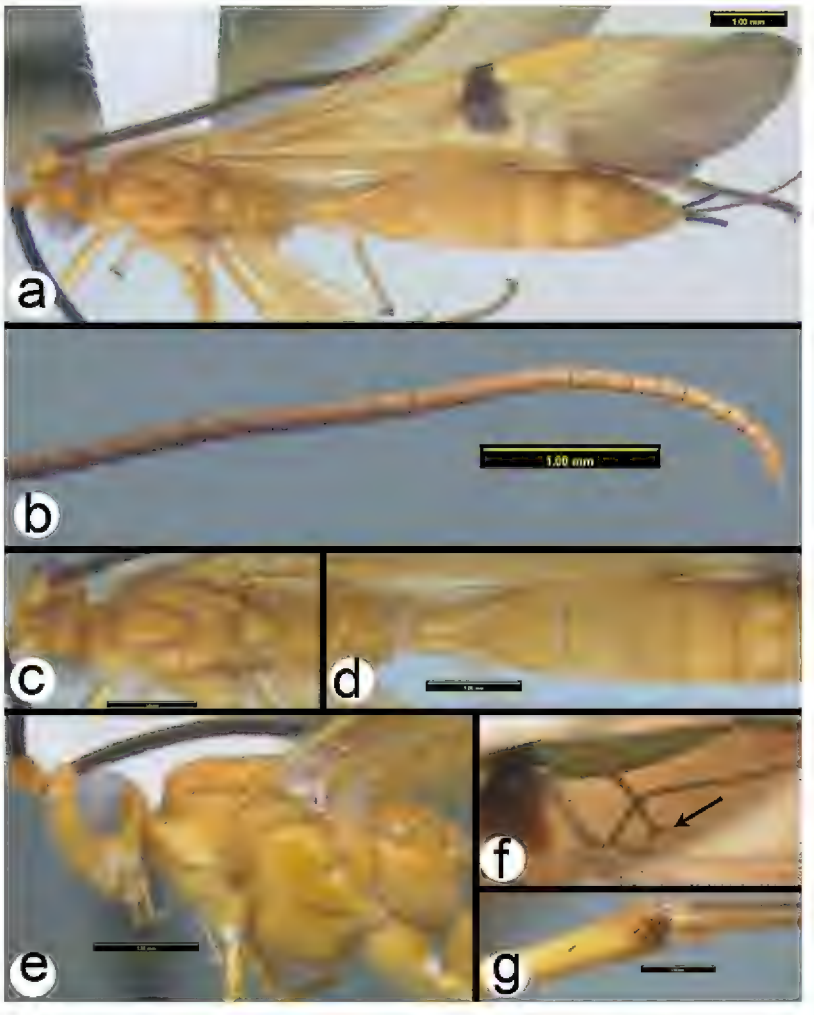


Figure 8. *Braunsia chaweewanae* sp. n. **a** dorsal habitus **b** antenna **c** dorsal head and mesosoma **d** dorsal propodeum and metasomal terga 1–3 **e** lateral head and mesosoma **f** fore wing showing short vein 2RS2 **g** hind tibia showing lateral spines.

Color. Yellow except as follows: the following are melanic: flagellum except apical segments, large parastigmal spot, distal 1/3 of fore wing and hind wing, apex of hind tibia and tarsus somewhat darkened.

Male. Unknown.

GenBank accession. *H245:* #HQ667950

Distribution. Known only from the holotype female from Thailand. Distribution maps can be found at http://purl.org/thaimaps/chaweewanae.

Material examined. Holotype female: H245, Thailand, Loei, Phu Ruea NP, Suan hin Palee, 17.4977°N 101.3425°E, 1178m, MT, 12–19.x.2006, Nukoonchai Jaroenchai [QSBG].

Braunsia comosa Enderlein

http://species-id.net/wiki/Braunsia_comosa

Figs 9–10

Braunsia comosa Enderlein 1920 [MZPW, examined] Indonesia (Sumatra)

Diagnosis. The color of this species is unique in that the mesosoma is yellow and black with most of the central areas of the sclerites black and the margins yellow, and the propodeum is mostly yellow. The first metasomal median tergite is long and narrow. The mesosoma, especially the propodeum laterally, is quite setose.

Male. Unknown.

Distribution. Besides the holotype from Indonesia (Sumatra) one specimen from Peninsular Malaysia is deposited in UKM. Distribution map can be found at http://purl.org/thaimaps/comosa. It is included here due to its likelihood of being present in southern Thailand.

Braunsia fumipennis (Cameron)

http://species-id.net/wiki/Braunsia_fumipennis

Figs 11–12

Microdus fumipennis Cameron 1899, original combination. [OUMNH, examined], North Eastern India

Braunsia pumatica van Achterberg and Long 2010, syn. n. [RMNH, examined], Vietnam.

Diagnosis. The color pattern is somewhat similar to that of *B. sumatrana*, but this is the only similarity between the species. The first median metasomal tergite of *B. fumipennis* is much narrower than that of *B. sumatrana* (compare figures 12f and 16c), and the first metasomal tergum of *B. fumipennis* is entirely melanic whereas that of *B. sumatrana* is white basally.

Variation. The mid femur varies from yellow to black; the fourth metasomal tergum varies from almost completely smooth to aciculate, and may or may not have

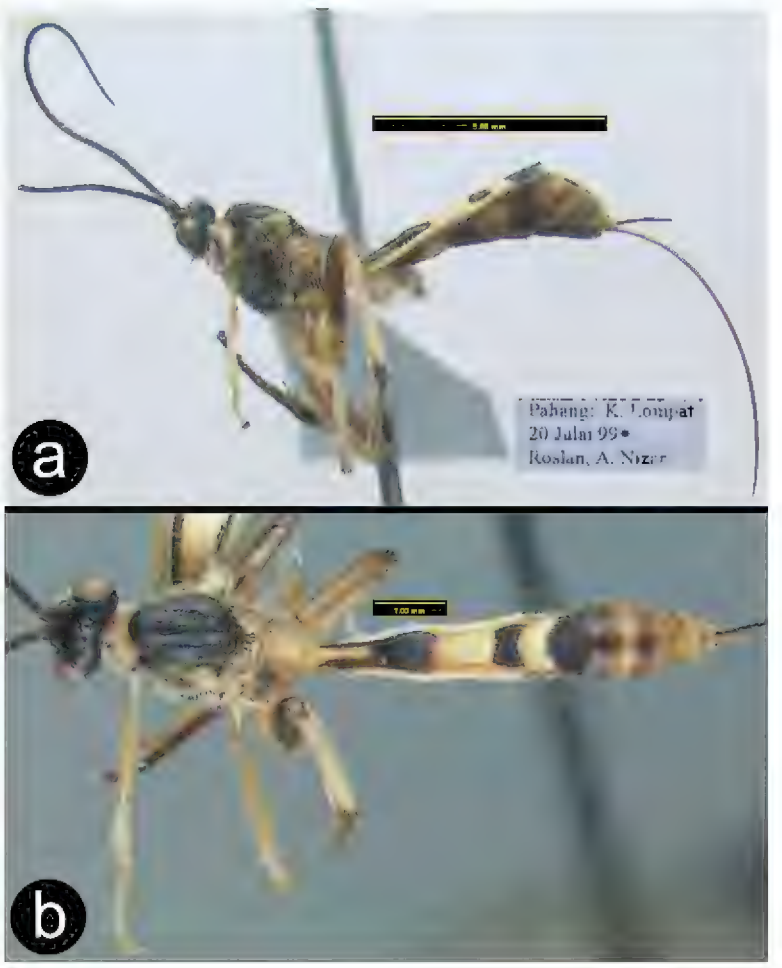


Figure 9. *Braunsia comosa* Enderlein **a** lateral habitus **b** dorsal habitus.

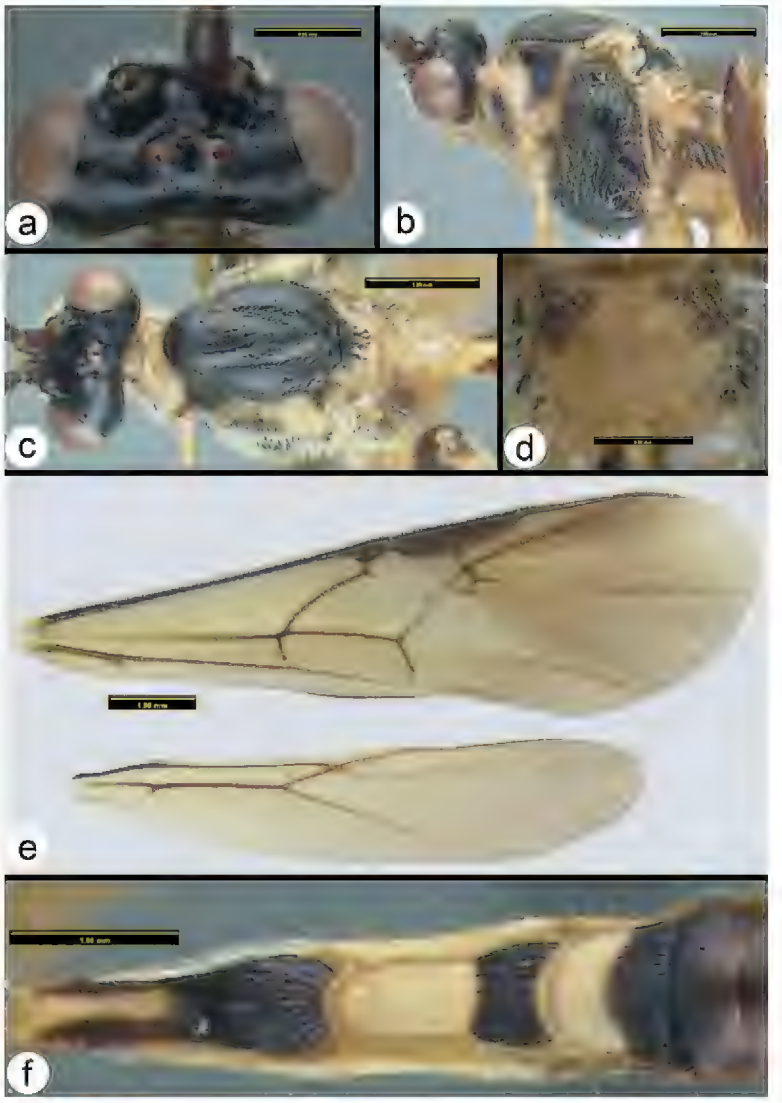


Figure 10. *Braunsia comosa* Enderlein **a** dorsal head **b** lateral mesosoma **c** dorsal head and mesosoma **d** dorsal propodeum **e** wings **f** dorsal metasomal terga 1–3.

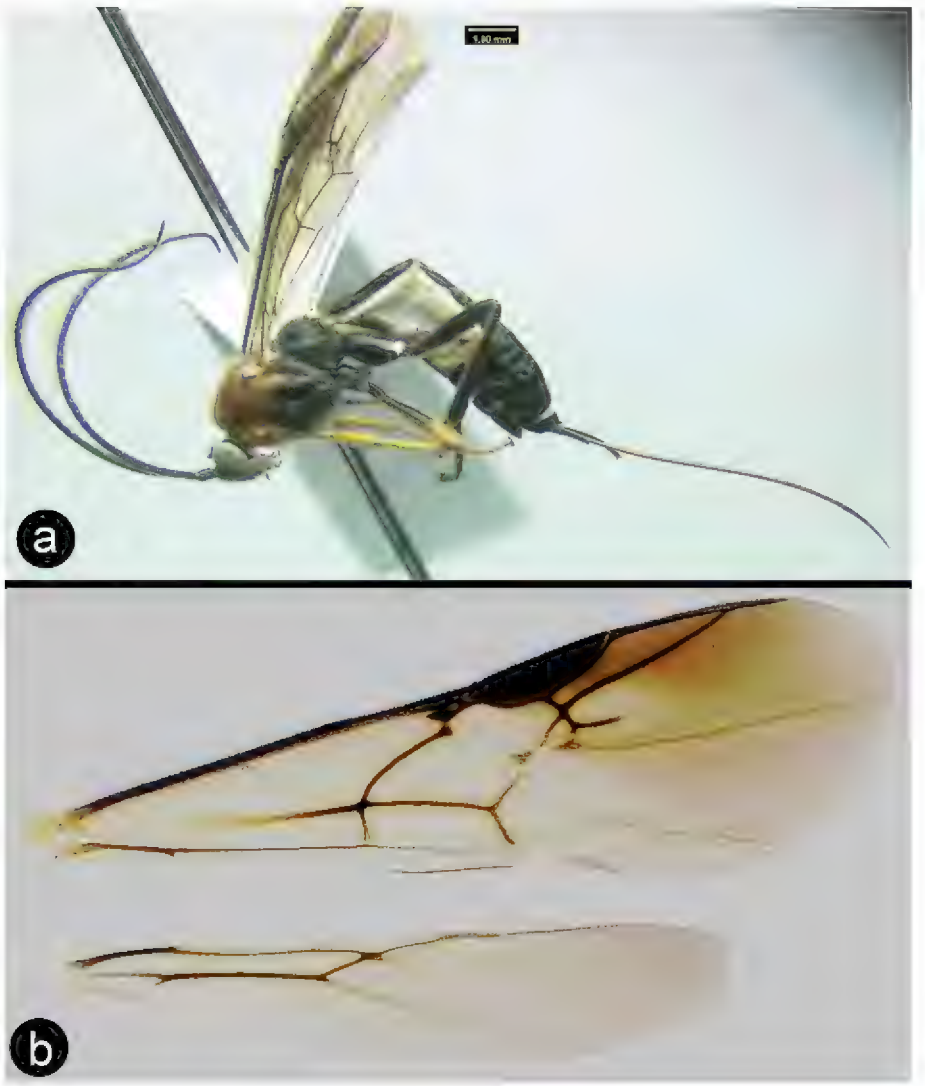


Figure 11. *Braunsia fumipennis* (Cameron) **a** lateral habitus **b** wings.

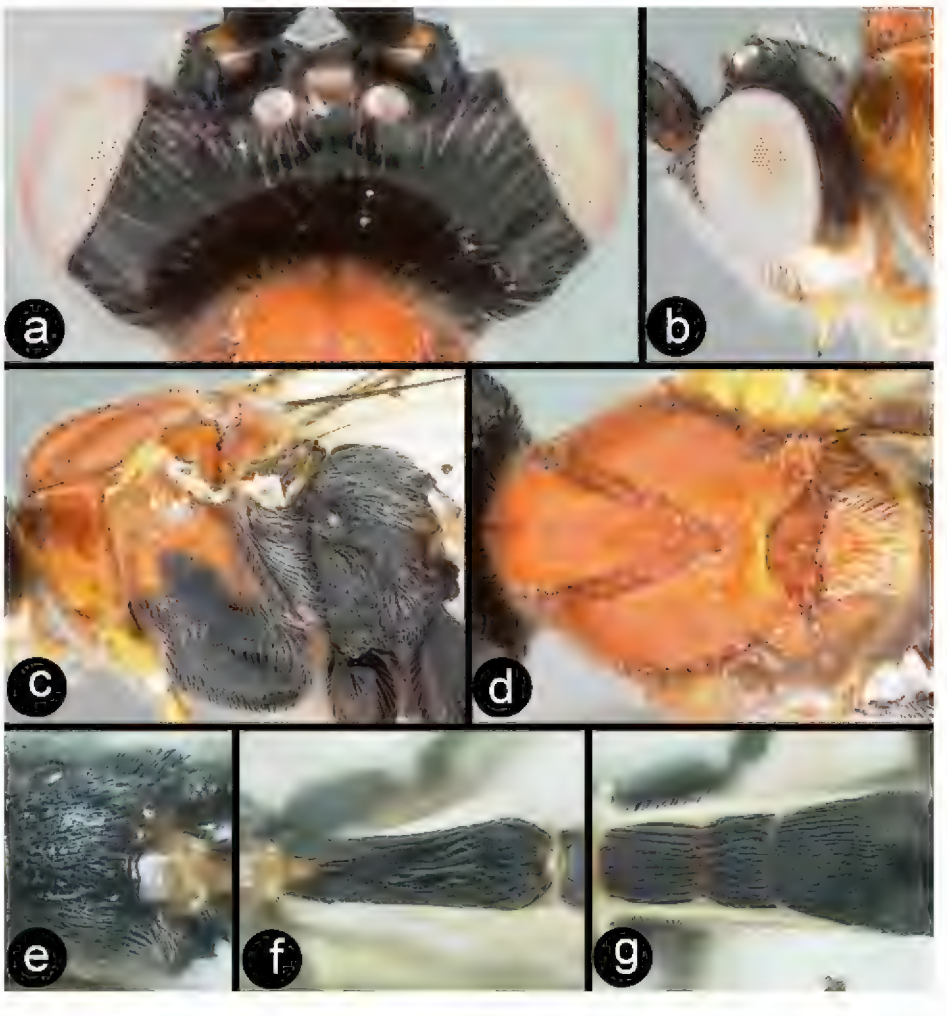


Figure 12. *Braunsia fumipennis* (Cameron) **a** dorsal head **b** lateral head **c** lateral mesosoma **d** dorsal mesothorax **e** dorsal propodeum **f** dorsal metasomal tergum 1 **g** dorsal metasomal terga 2 and 3.

several transverse rows of setae. None of these character states are correlated in such a manner as to suggest different species.

GenBank accessions. *H393:* #HQ667947. *H915:* #HQ667946. *H140:* #HQ667975.

Distribution. North eastern India, Myanmar, Thailand, and Vietnam. This is a wide distribution but the specimens from disparate areas vary only in minor details. Distribution map from Thailand and Myanmar can be found at http://purl.org/thaimaps/fumipennis.

Examined specimens are deposited in OUMNH, RMNH, BMNH, HIC, and QSBG.

Braunsia smithii (Dalla Torre)

http://species-id.net/wiki/Braunsia_smithii

Figs 13–14

Agathis smithii Dalla Torre 1898. [OUMNH, examined] Replacement name for *Agathis flavipennis* Smith 1863, Ceram Island, Indonesia, a primary homonym of *Agathis flavipennis* Brullé 1846. The latter is a species of *Biroia*.

Braunsia devriesi van Achterberg and Long 2010, syn. n. [RMNH, examined], Vietnam.

Diagnosis. Similar species include *B. maculifera* van Achterberg and Long, *B. pappi* Chen and Yang 2006, *B. margaroniae* Bhat and Gupta 1977, *B. bimaculata* Enderlein 1920, *B. bipunctata* Enderlein 1920, *B. matsumurai* Watanabe 1937, and *B. tuberculata* Cameron 1899. All of these differ in having more melanic color either on the wings or on the body or both, and most have the first metasomal median tergite somewhat wider than *B. smithii*. The first metasomal median tergite is about twice as long as wide apically in *B. smithii*, whereas the aforementioned nominal species are approximately 1.5 times as long as wide. Undoubtedly there are more synonymies to be made amongst these nominal species but that is beyond the scope of this paper. *B. smithii* is also similar to *B. chaweewanae*; see the diagnosis of that species for differences between the two.

Notes. The type of B. *smithii* is from Ceram Island, Indonesia (Wallacea). Thus the geographic range of the species is wide. Despite this, examination of specimens from this wide range provides no morphological grounds on which to separate the two nominal species. As a warning to future revisers, all older specimens examined, and these include specimens from Peninsular Malaysia and Borneo, have an oily residue that causes the cuticle to darken in a variety of patterns depending on where the substance contacts the cuticle. This is especially apparent on the metasoma.

GenBank accessions. *H292:* #HQ667948. *H906:* #HQ667949.

Distribution. Examined specimens are from Malaysia (Borneo and Peninsular Malaysia), Thailand, Vietnam, and Indonesia (South Moluccas). It is undoubtedly much more widespread. Distribution map can be found at http://purl.org/thaimaps/smithii.

Specimens are deposited in OUMNH, RMNH, MZPW, BMNH, HIC, UKM, and QSBG.

Figure 13. *Braunsia smithii* (Dalla Torre) **a** lateral habitus **b** fore wing.

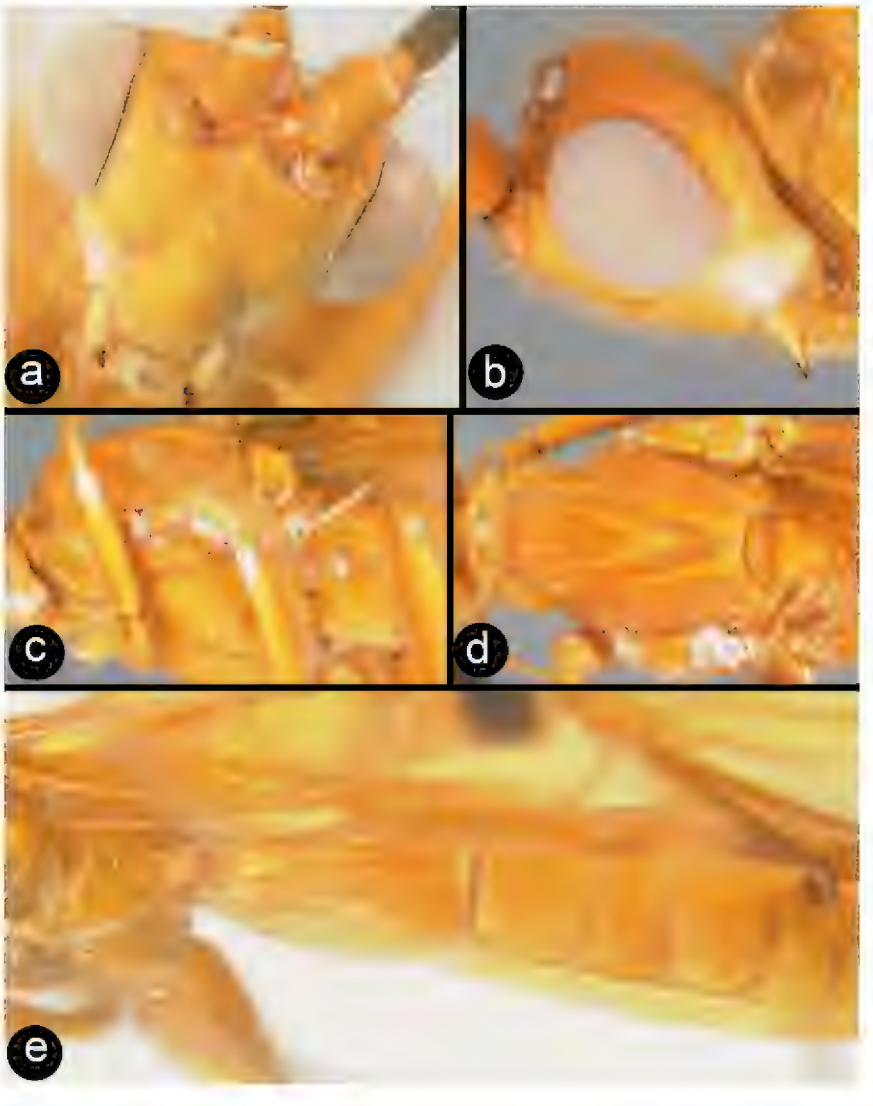


Figure 14. *Braunsia smithii* (Dalla Torre) **a** anterior head **b** lateral head **c** lateral mesosoma **d** dorsal mesothorax **e** dorsal propodeum and metasomal terga 1–3.

***Braunsia sumatrana* Enderlein**
http://species-id.net/wiki/Braunsia_sumatrana
Figs 15–16

Braunsia sumatrana Enderlein 1920 [MZPW, examined]

Diagnosis. Large specimens with unique coloration; especially noteworthy is the extent of white coloration on the first metasomal median tergite.

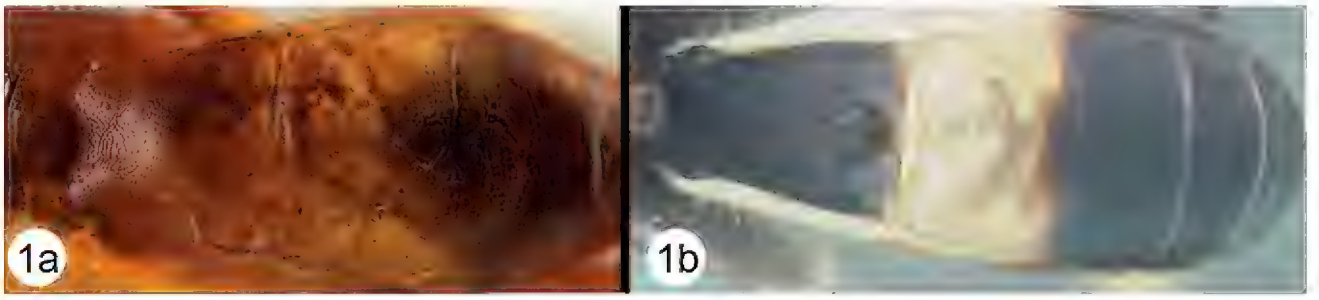
Distribution. Indonesia (Sumatra), Malaysia (Borneo and Peninsular Malaysia). It is included here because of the likelihood that its range extends into southern Thailand. Distribution map can be found at http://purl.org/thaimaps/sumatrana.

Examined specimens are deposited in HIC, UKM, RMNH, USNM.

Key to Thai species of *Camptothlipsis*

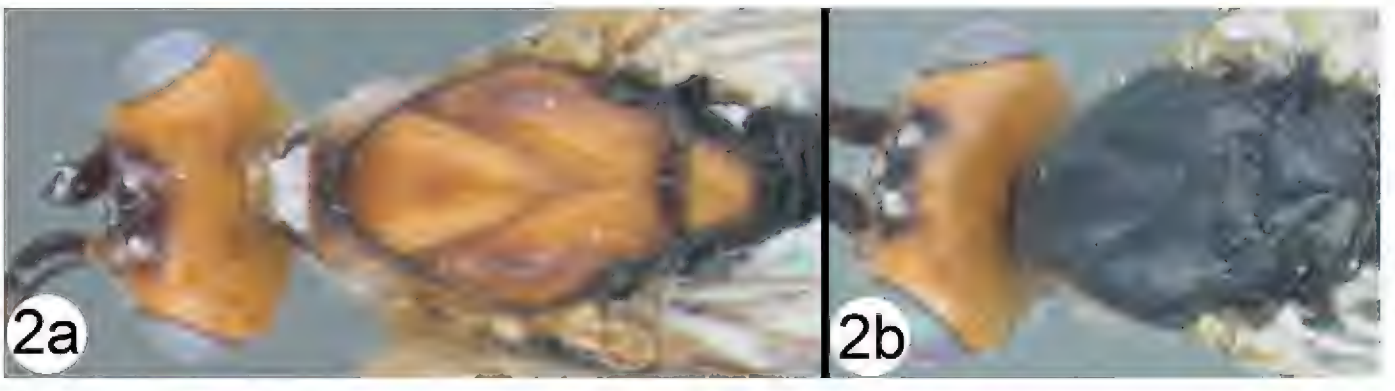
1a Metasomal terga almost entirely orange, and lacking a distinct white band, head entirely orange..... ***C. hanoiensis* van Achterberg & Long**

1b Metasomal terga mostly or entirely melanic with or without a pale transverse band on median tergite 2.....**2**



2a Mesoscutum almost entirely orange..... ***C. philippinensis* Gupta & Bhat**

2b Mesoscutum entirely melanic or almost so.....**3**



3a Penultimate labial palpomere about ½ the length of the apical palpomere (Note: the second palpomere, that which is next to the basal palpomere, is present and it is the thickest palpomere; in this side of the couplet there should be two palpomeres distal to it); mid tibia with more than 8 lateral spines..... ***C. nigra* Gupta & Bhat**

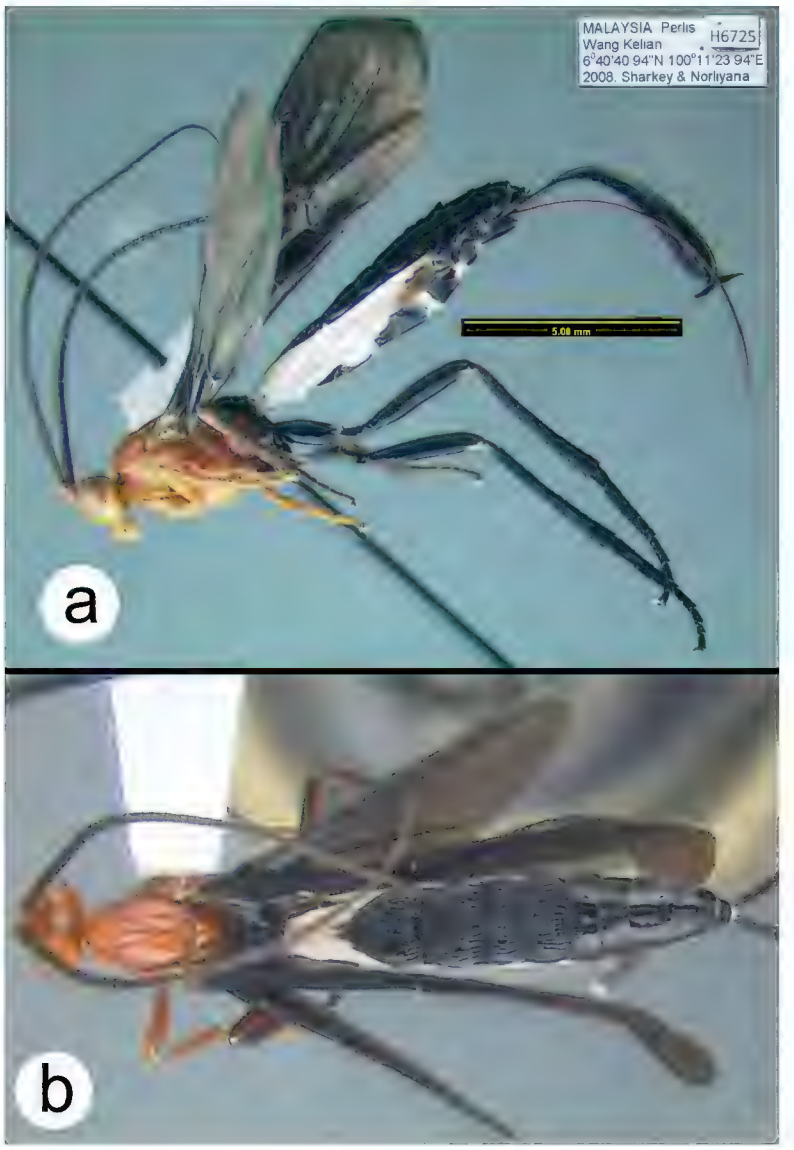


Figure 15. *Braunsia sumatrana* Enderlein **a** lateral habitus **b** dorsal habitus.

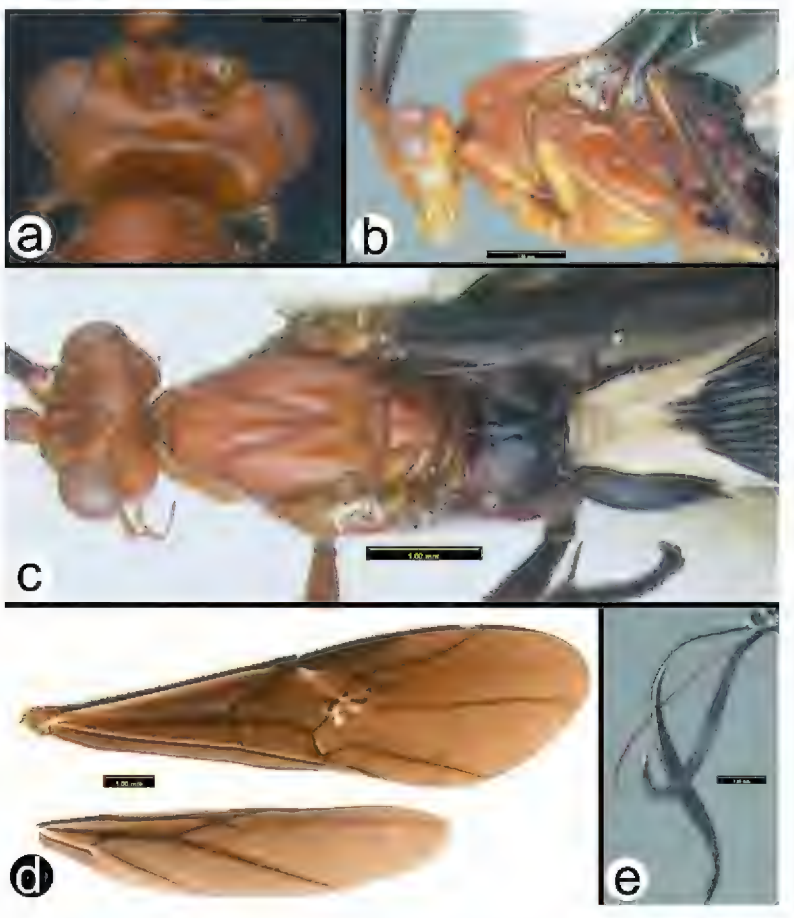
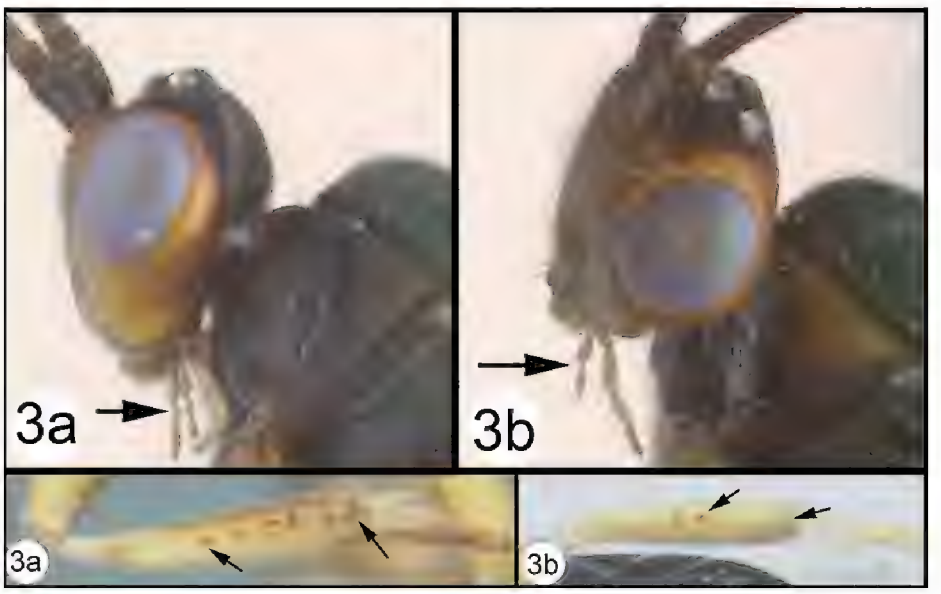
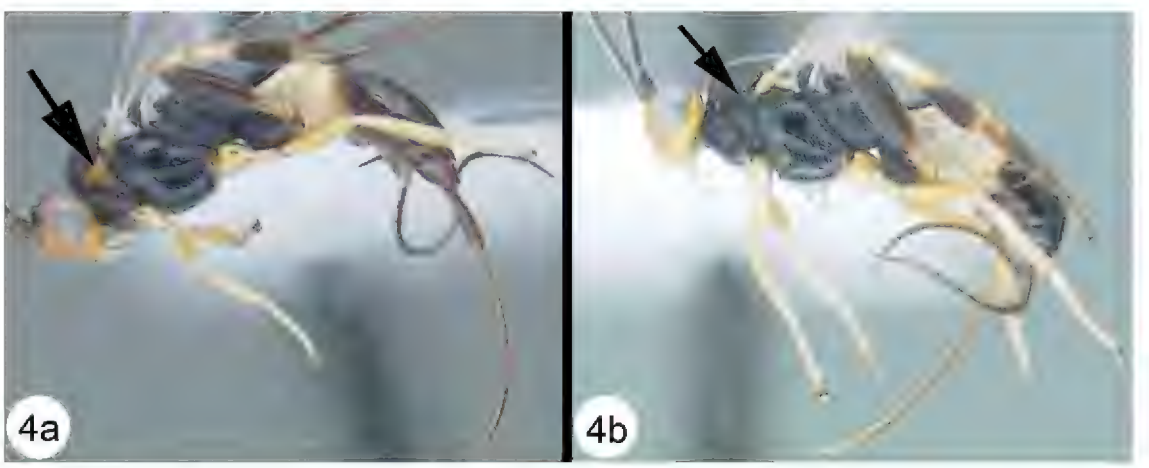


Figure 16. *Braunsia sumatrana* Enderlein **a** dorsal head **b** lateral head and mesosoma **c** dorsal head and mesosoma **d** wings **e** ovipositor and sheaths.

3b Penultimate labial palpomere absent or barely perceptible (Note: only one apparent palpomere distal to the thickest palpomere); mid tibia with less than 6 lateral spines **4**



4a Posterodorsal corner of pronotum orange ..... ***C. sheilae* Sharkey, sp. n.**
4b Posterodorsal corner of pronotum melanic... ***C. annemariae* Sharkey, sp. n.**



***Camptothlipsis annemariae* Sharkey, sp. n.**
urn:lsid:zoobank.org:act:616728A7-5F48-403D-8FD9-5BE69950601B
http://species-id.net/wiki/Braunsia_annemariae
Figs 17–18

Diagnosis. Very similar to its sister species, *C. sheilae*. Similarities include median tergite 2 weakly granulate, pronotum mostly smooth posterodorsally (in the lateral corner) and 28S sequence data that differ at only 3 sites (of roughly 600 base pairs total) (Fig. 2). *Camptothlipsis annemariae* differs as follows: pronotum melanic orange in posterolateral corner, ovipositor distinctly shorter than body (see couplet 4 above to compare ovipositor lengths).

Description. Holotype female.

Body length. 3.0 mm.

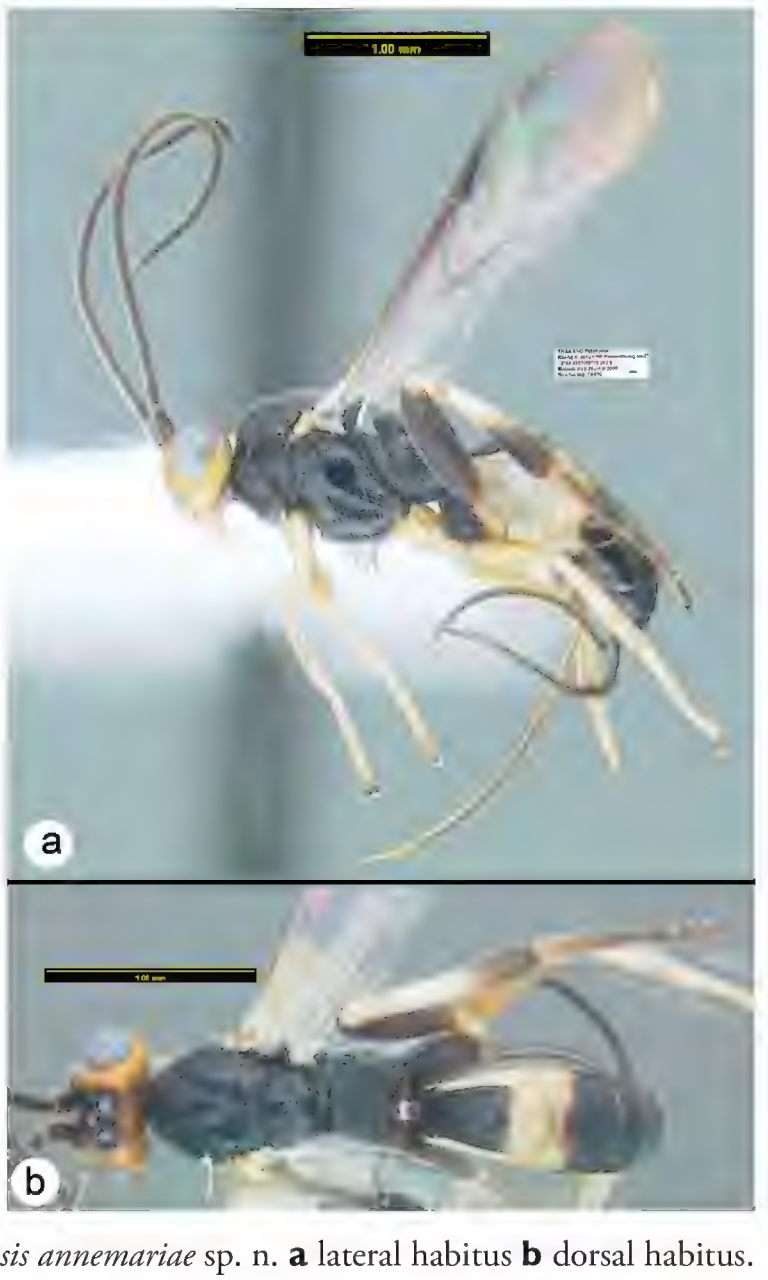


Figure 17. *Camptothlipsis annemariae* sp. n. **a** lateral habitus **b** dorsal habitus.

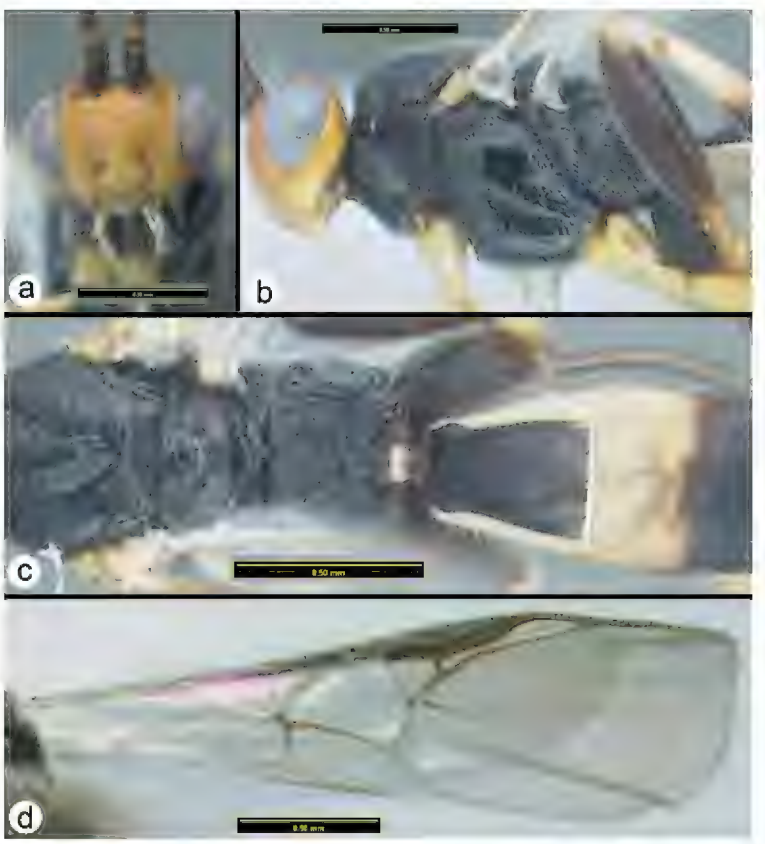


Figure 18. *Camptothlipsis annemariae* sp. n. **a** anterior head **b** lateral head and mesosoma **c** dorsal mesosoma and metasomal terga 1 and 2 **d** fore wing.

Head. Third labial palpomere not visible under a light microscope at 80x (uncertain whether or not a small palpomere remains), OOL 0.14; POD 0.05; IOL 0.11; 27 flagellomeres.

Mesosoma. Pronotum mostly smooth posterodorsally (in the lateral corner); sternaulus well impressed and distinctly crenulate for ¾ mesopleuron length; propodeum evenly areolate rugulose with small areolae; midleg with 5–6 spines; hind leg with 5 spines.

Metasoma. First metasomal median tergite (T1) 1.3 times longer than wide apically and distinctly granulate; T2 weakly granulate, remaining median tergites smooth.

Male. Unknown.

GenBank accession. *H394:* #HQ667953

Distribution. Known only from the type specimen in Thailand. Distribution map can be found at http://purl.org/thaimaps/anemariae.

Etymology. Named in honor of the first author's sister, Annemarie.

Material examined. Holotype female: H394, Thailand, Petchaburi, Kaeng Krachan NP, Panernthung/km27, 12.822°N 99.371°E, MT, 25.i-4.ii.2009, Sirichai [QSBG].

Camptothlipsis hannoiensis van Achterberg & Long

http://species-id.net/wiki/Camptothlipsis_hannoiensis

Camptothlipsis hannoiensis van Achterberg & Long 2010, [RMNH, examined] Vietnam.

Diagnosis. The extensive pale color of the body is not found in other Thai species.

Distribution. The species is only known from Vietnam and is included here due to the possibility that it may occur in Thailand. See van Achterberg and Long (2010).

Camptothlipsis nigra Gupta & Bhat

http://species-id.net/wiki/Camptothlipsis_nigra

Figs 19–22

Camptothlipsis niger Gupta and Bhat 1974 [USNM, examined] Indonesia (Java)

Note: The generic name is feminine therefore the code requires that gender of the species name be changed to agree.

Diagnosis. Quite variable in coloration; mesosoma from mostly black to extensively pale especially laterally; median tergite 2 from completely pale to mostly melanic with a pale transverse band basally. Third labial palpomere well developed, more than 9 spines on the mid tibia. Figures 19, 20 and 21 are of Thai specimens, figure 22 illustrates the holotype.

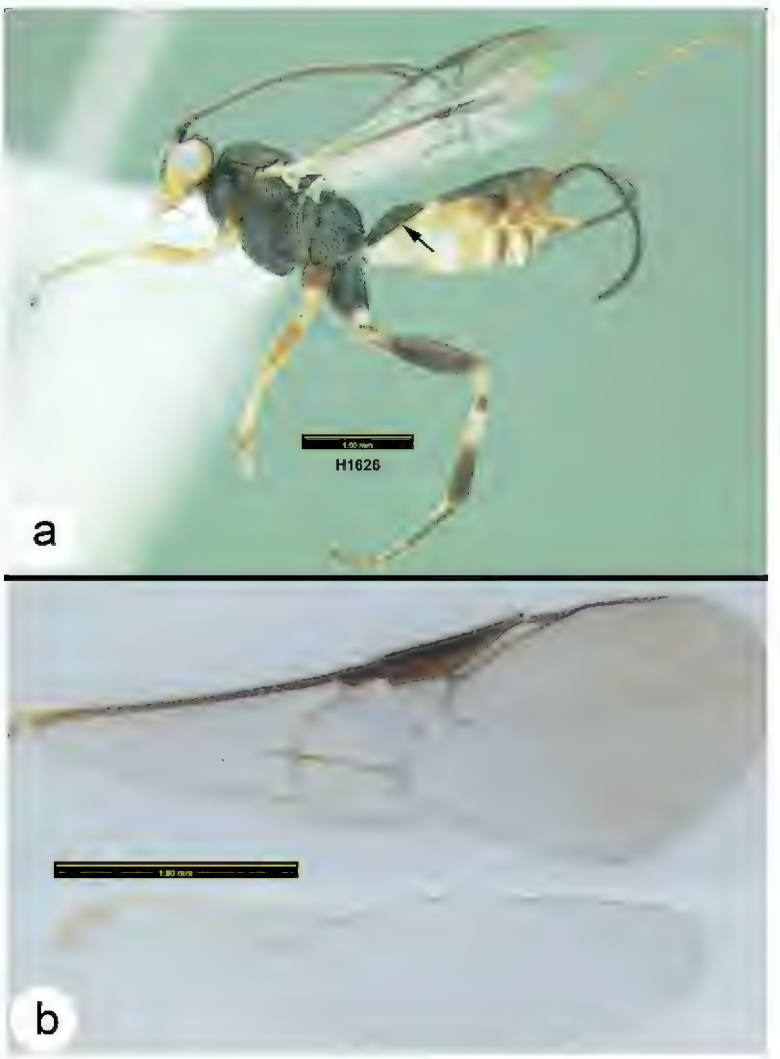


Figure 19. *Camptothlipsis nigra* Gupta and Bhat, melanic specimen **a** lateral habitus **b** wings.

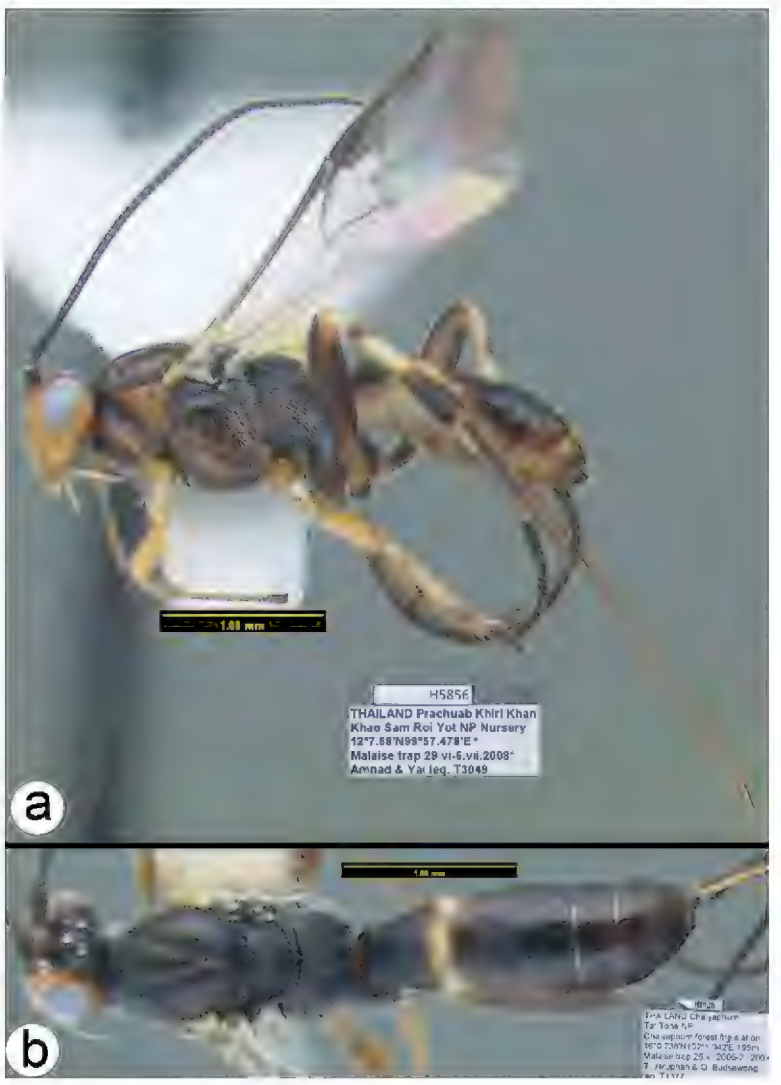


Figure 20. *Camptothlipsis nigra* Gupta and Bhat, pale specimen **a** lateral habitus **b** dorsal habitus.

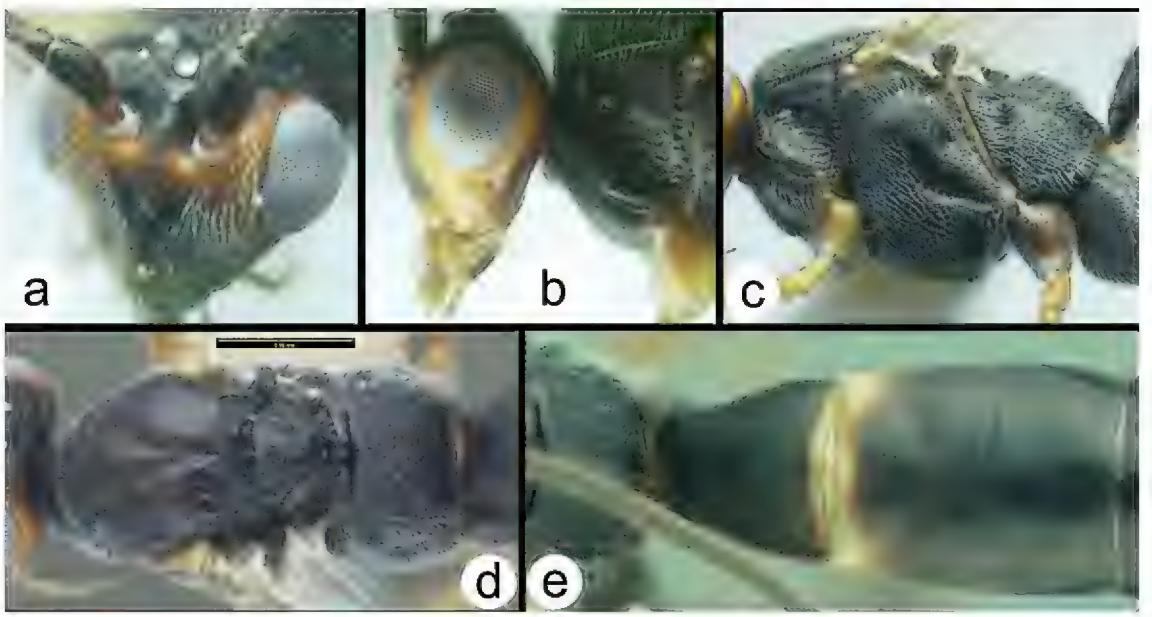


Figure 21. *Camptothlipsis nigra* Gupta and Bhat, melanic specimen **a** anterodorsal head **b** lateral head **c** lateral mesosoma **d** dorsal mesosoma **e** dorsal propodeum and metasomal terga 1–3.

Figure 22. *Camptothlipsis nigra* Gupta & Bhat, holotype, lateral habitus.

GenBank accessions. *H096:* #HQ667952. *H433:* #HQ667951. *H546:* #HQ667957. *H1627:* #HQ667955. *H1635:* #HQ667956.

Description. The holotype is well described in Gupta and Bhat (1974). Based on the original description, and the name of the species, we assume that the melanic color of the type specimen has faded. Below are a few details for the Thai specimens.

Body length: 3.7 - 3.8 mm. Penultimate labial palpomere well developed. OOL 0.17; POD 0.06; IOL 0.10; 26 flagellomeres. Mid tibia with 9–10 spines; hind tibia with 12–13 spines. First metasomal median tergite (T1) 1.3 times longer than wide apically and distinctly granulate; sculpture of T2 distinctly granulate, remaining median tergites smooth.

Distribution. The holotype is from Java and other specimen records include eastern India and Thailand. Distribution map of the Thai specimens can be found at http://purl.org/thaimaps/nigra.

Specimens are deposited in the USNM (holotype, and paratypes), CNC (paratypes), other examined specimens are deposited in QSBG, HIC and RMNH.

***Camptothlipsis philippinensis* Gupta & Bhat**
http://species-id.net/wiki/Camptothlipsis_philippinensis
Figs 23–26

Camptothlipsis philippinensis Gupta & Bhat 1974

Diagnosis. The pale color of this species is enough to distinguish it from others in Thailand. The penultimate labial palpomere is well developed. Figures 22 and 23 are of the sole Thai specimen, a male. Figures 24 and 25 are of the holotype.

Distribution. Known only from Philippines and Thailand. Distribution map of the Thai specimens can be found at http://purl.org/thaimaps/philippinensis.

The holotype, from The Philippines, is deposited in the USNM and the Thai specimen is in QSBG.

***Camptothlipsis sheilae* Sharkey, sp. n.**
urn:lsid:zoobank.org:act:B1A13E1D-79A9-4572-89FD-4BF59E461905
http://species-id.net/wiki/Camptothlipsis_sheilae
Figs 27–28

Diagnosis. Very similar to its sister species, *C. annemariae*. Similarities include median tergite 2 weakly granulate; pronotum mostly smooth posterodorsally (in the lateral corner) and 28S sequence data that differ at 3 sites (Fig. 2). *Camptothlipsis sheilae* differs as follows: pronotum yellowish orange in posterolateral corner, ovipositor about as long as body.

Description. Holotype female.

Body length. 3.4 mm.

Head. Third labial palpomere not visible under a light microscope at 80x (uncertain if a small palpomere remains) OOL 0.15; POD 0.06; IOL 0.10; 26 flagellomeres.

Mesosoma. Pronotum mostly smooth posterodorsally (in the lateral corner); sternaulus well impressed and distinctly crenulate for ¾ mesopleuron length; propodeum evenly areolate rugulose with small areolae; mid leg with 4 spines; hind leg with 7 spines.

Metasoma. First metasomal median tergite (T1) 1.3 times longer than wide apically and distinctly granulate; T2 weakly granulate, remaining median tergites smooth.

Color. Head orange with black in ocellar triangle. Most of mesosoma black; posterolateral corner of pronotum yellowish orange. Median tergites melanic except median tergite 2 yellowish white.

Male. Unknown.

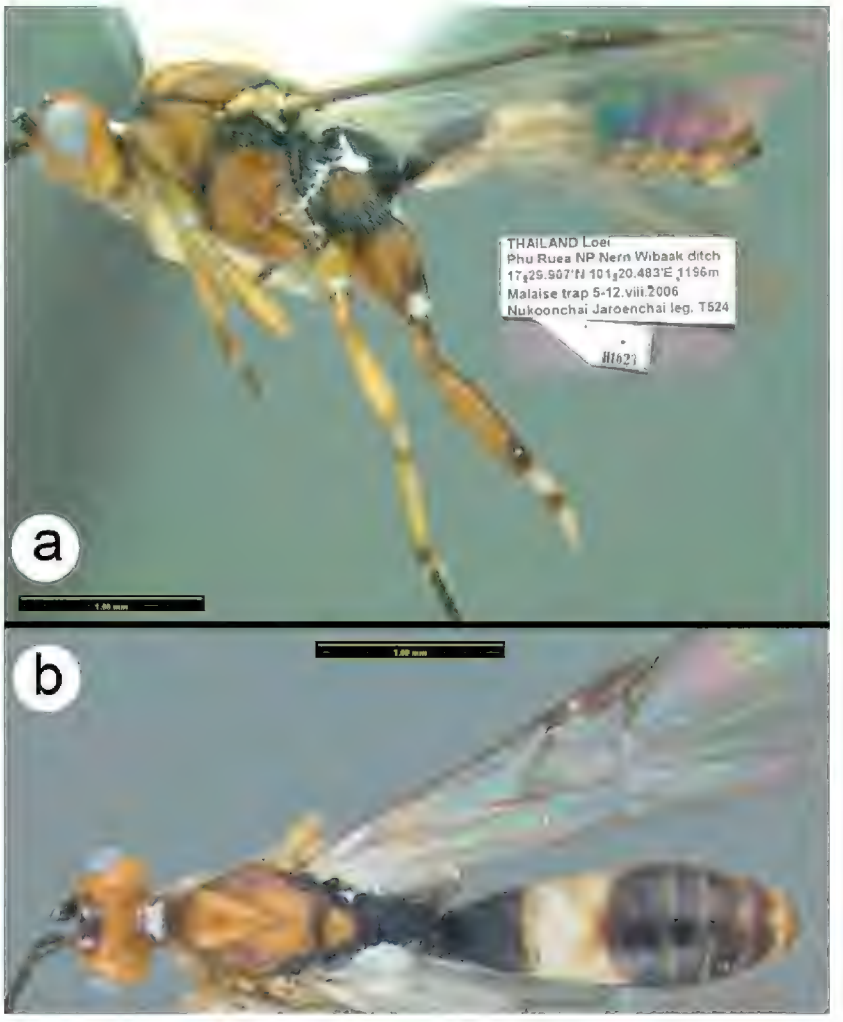


Figure 23. *Camptothlipsis philippinensis* Gupta & Bhat **a** lateral habitus **b** dorsal habitus.

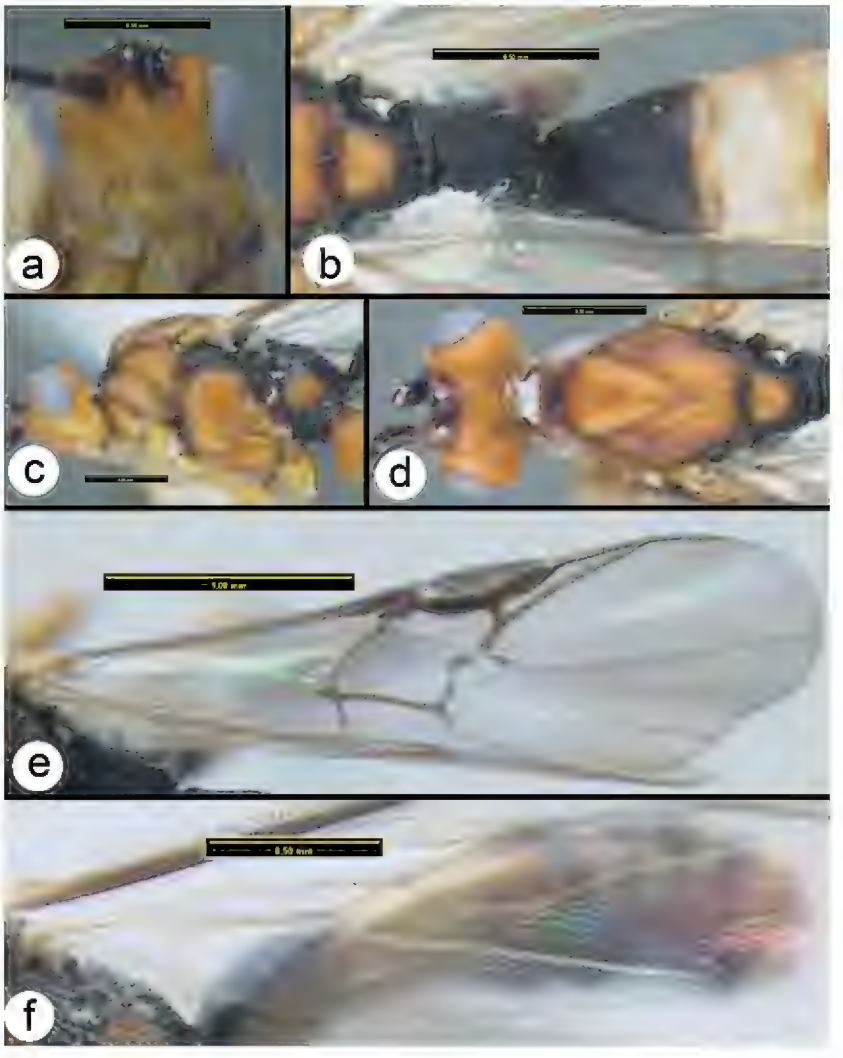


Figure 24. *Camptothlipsis philippinensis* Gupta & Bhat **a** anterior head **b** dorsal propodeum and metasomal terga 1 and 2 **c** lateral head and mesosoma **d** dorsal head and mesothorax **e** fore wing **f** hind wing.

Figure 25. *Camptothlipsis philippinensis* Gupta & Bhat, holotype **a** lateral habitus **b** dorsal habitus.

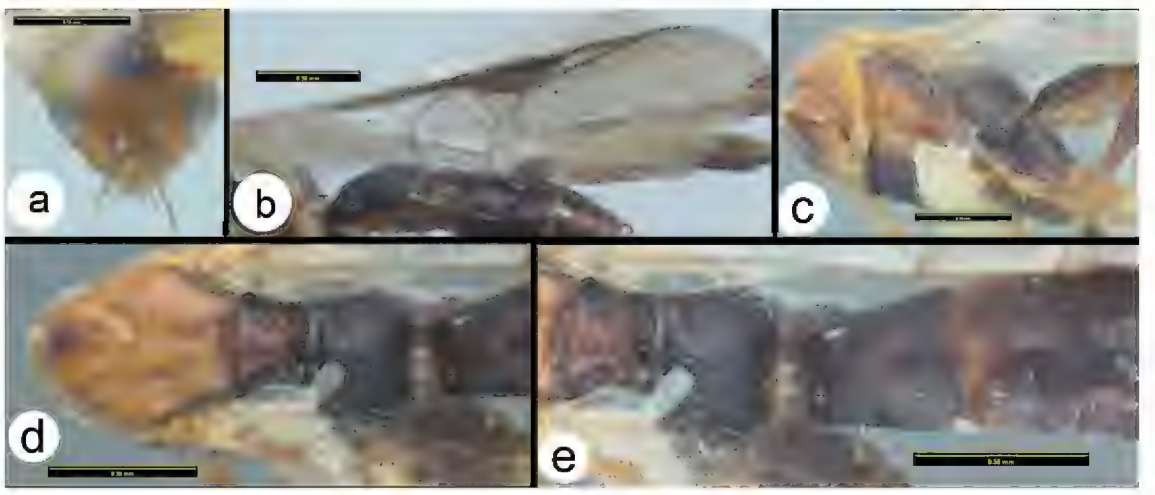


Figure 26. *Camptothlipsis philippinensis* Gupta & Bhat, holotype **a** anterior head **b** fore wing **c** lateral mesosoma **d** dorsal mesosoma **e** dorsal propodeum and metasomal terga 1 and 2.

GenBank accession. *H664:* #HQ667954

Distribution. Known only from the type specimen in Thailand. Distribution map can be found on http://purl.org/thaimaps/sheilae.

Etymology. Named in honor of the first author's sister, Sheila.

Material examined. Holotype female: H664, Thailand, Kanchanaburi, Khuean Srinagarindra NP, Tha Thung-na/Chong Kraborg, 14.5°N 98.884°E, 210m, MT, 9–16.iv.2009 Boonnam & Phumarin [QSBG].

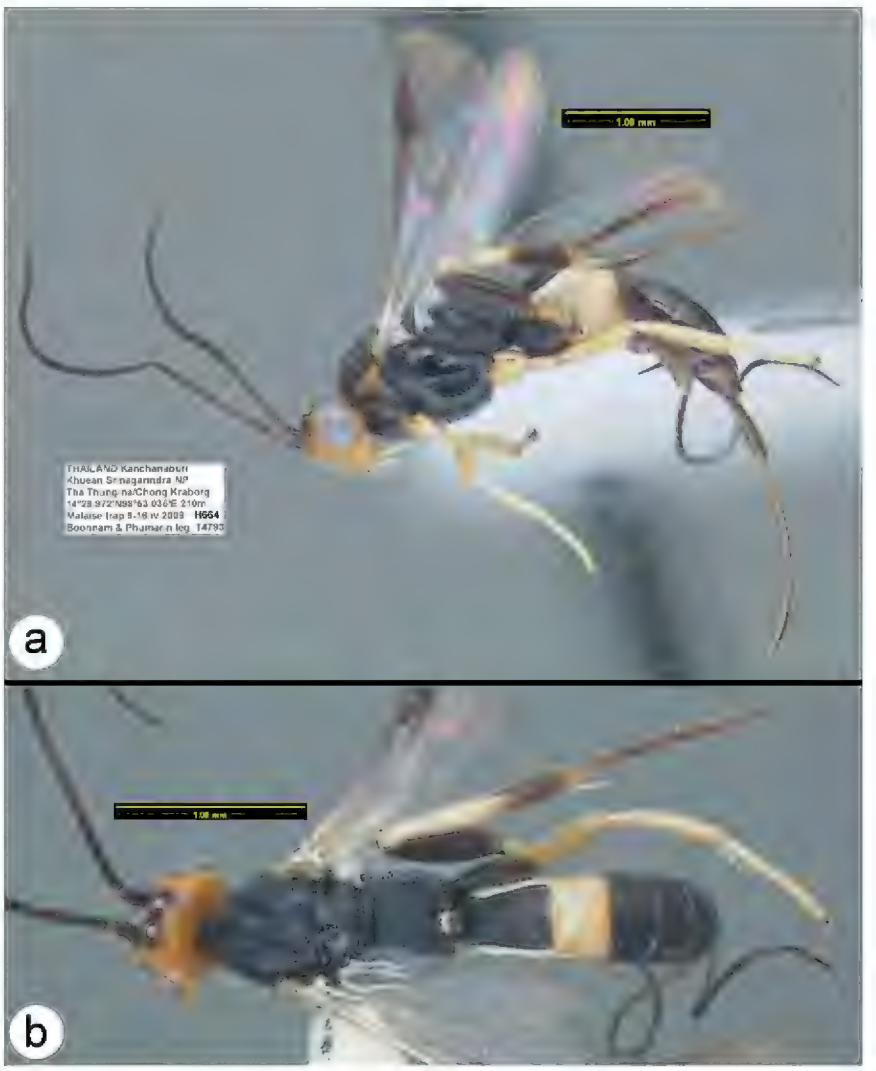


Figure 27. *Camptothlipsis sheilae* sp. n. **a** lateral habitus **b** dorsal habitus.

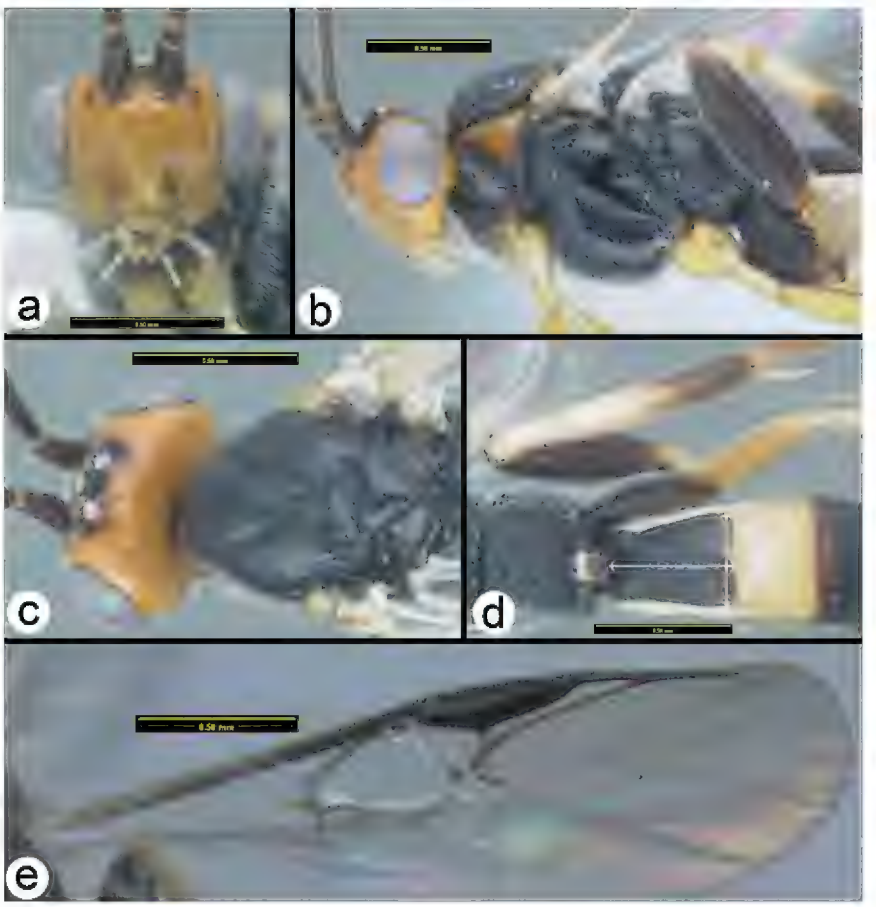


Figure 28. *Camptothlipsis sheilae* sp. n. **a** anterior head **b** lateral head and mesosoma **c** dorsal head and mesothorax **d** dorsal propodeum and metasomal terga 1 and 2. Arrows show positions for length and width measurements **e** fore wing.

Coccygidium

Key to Thai species of *Coccygidium*

1a Fore wing melanic distally with a melanic spot near parastigma. Scape entirely melanic or with some weak pale infusions medially..... ..... ***C. phaeoscapos* Sharkey, sp. n.**

1b Fore wing weakly melanic distally with a basal transverse melanic band posterad parastigma (note the dark veins in this area). At least half of scape pale; scape half melanic (laterally) and half yellow (medially)..... ..... ***C. mastigion* Sharkey, sp. n.**

1c Fore wing mostly hyaline with slight infuscation distally and small melanic area around parastigma; scape mostly yellow with a thin melanic stripe laterally..... ***C. malayensis* (Bhat & Gupta)**

***Coccygidium malayensis* (Bhat & Gupta, 1977), comb. n.**
http://species-id.net/wiki/Coccygidium_malayensis
Figs 29–32

Zelomorpha malayensis Bhat and Gupta 1977 [AEI, type examined], Peninsular Malaysia.

Diagnosis. Fore wing almost evenly hyaline; scape with a narrow melanic band laterally. There is a widespread undescribed species in peninsular Malaysia that is very similar to *C. malayenisis*. The undescribed species differs as follows: ocular- ocellar length (OOL) longer, almost twice as long as lateral ocellar diameter. Yellow coloration on stigma less than 1/3 of stigma surface.

Description. ***Body length***. 6.7mm

Head. OOL 0.19; POD 0.14; IOL 0.08; EH 0.85; MS 0.20; 46 flagellomeres.

Figure 29. *Coccygidium malayensis* holotype **a** lateral habitus **b** wings.

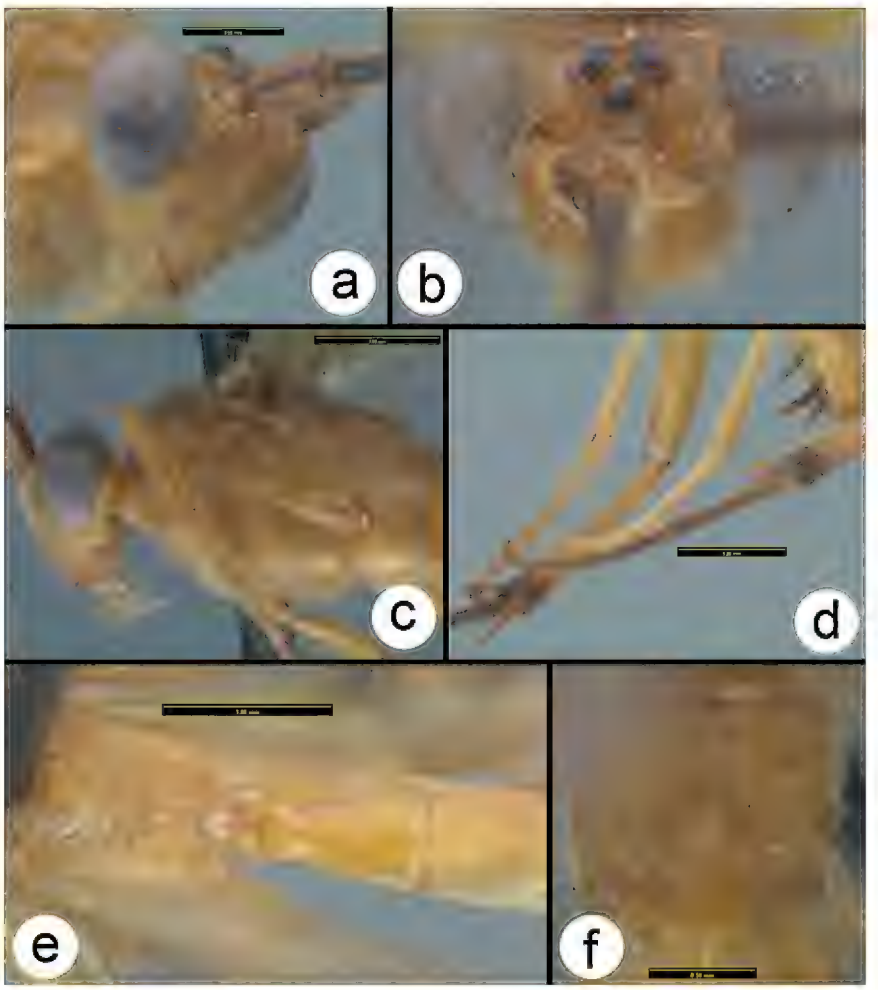


Figure 30. *Coccygidium malayensis* holotype **a** anterolateral head **b** dorsal head **c** lateral head and mesosoma **d** legs **e** dorsal propodeum and metasomal terga 1 and 2 **f** dorsal propodeum.

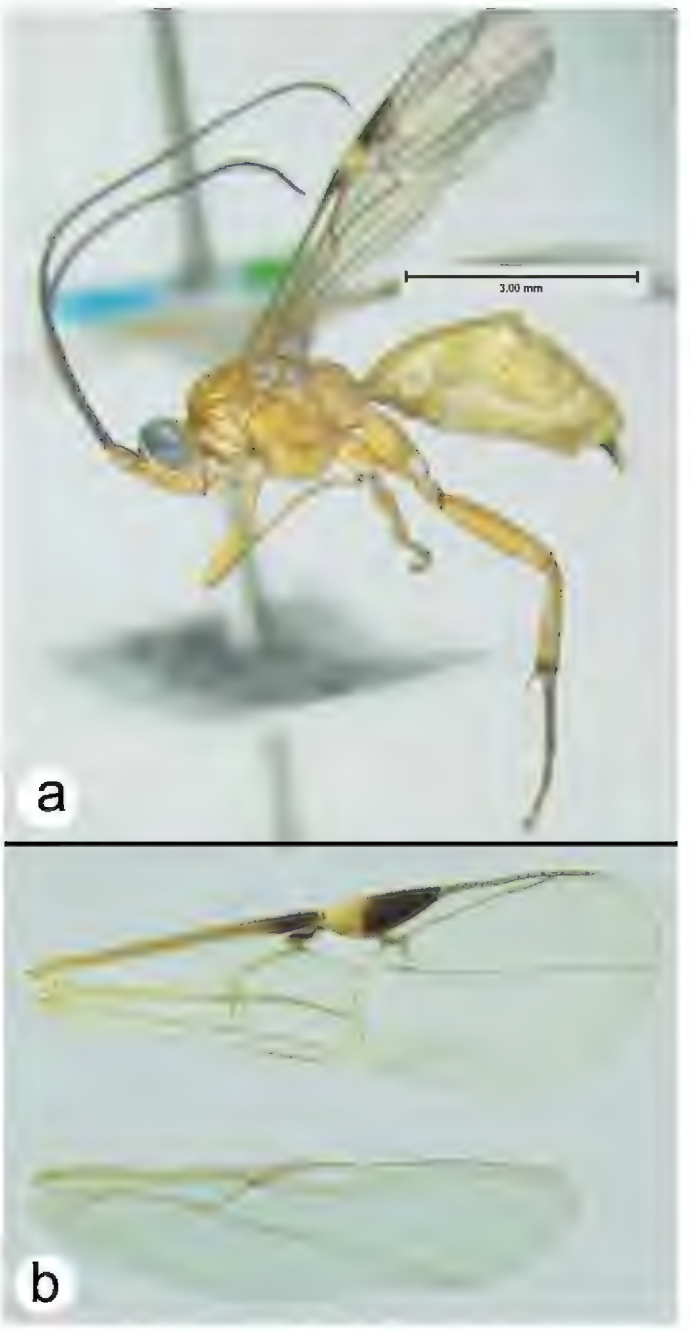


Figure 31. *Coccygidium malayensis* **a** lateral habitus **b** wings.

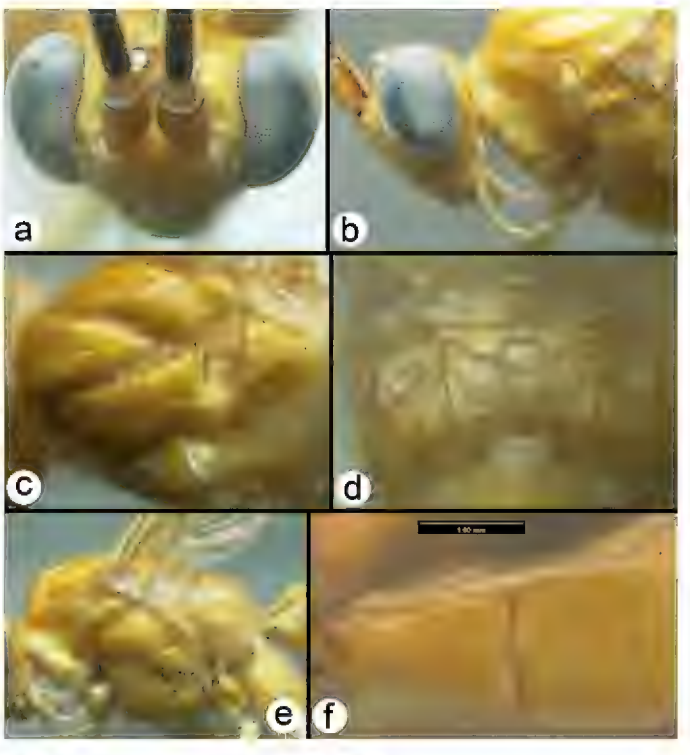


Figure 32. *Coccygidium malayensis* **a** dorsal head **b** lateral head and prothorax **c** dorsal mesoscutum **d** dorsal propodeum **e** lateral mesosoma **f** dorsal metasomal terga 1 and 2.

Mesosoma: Mesoscutum punctate; notauli well impressed and crenulate; scutellum with apical carina and subapical transverse depression; sternaulus well impressed and crenulate, extending about ¾ length of mesopleuron; metapleuron rugose in ventral 1/3, punctate dorsally; fore tibial spur as long as basitarsus.

Metasoma. Median tergite 1 about twice as long as wide apically (length = 1.11mm, width = 0.54mm).

Color. Yellow except as follows: flagellum melanic, scape yellow except for narrow melanic stripe laterally, pedicel yellow; tip of hind tibia black, hind tarsomeres brown to black, hind tibial spurs pale brown. Fore wing almost evenly hyaline, veins mostly yellow, somewhat more melanic apicoanteriorly; stigma yellow in basal 1/3 to 1/2, vein R pale from stigma to union with RS. Hind wing hyaline with yellow veins.

Male. Eyes are somewhat smaller than those of the female. This may be typical of most nocturnal species of *Coccygidium*. OOL 0.22; POD 0.13; IOL 0.12; EH 0.69; MS 0.29; 45 flagellomeres.

GenBank accessions. *H071:* #HQ667960. *H075:* #HQ667959. *H086:* #HQ667961. *H971:* # HQ667958

Distribution. Thailand and Peninsular Malaysia. Distribution map can be found at http://purl.org/thaimaps/malayensis.

Material examined. Holotype female. Malaysia, Kuala Lumpur, Selangor, 1950, AEI. Identified specimens are deposited in HIC, AEI, RMNH, QSBG, and UKM.

Coccygidium mastigion **Sharkey, sp. n.**
urn:lsid:zoobank.org:act:064BB16F-9390-4E81-8EBB-ACB8ADBF573F
http://species-id.net/wiki/Coccygidium_mastigion
Figs 33–34

Diagnosis. Fore wing weakly melanic distally with a basal transverse melanic band posterad parastigma. Scape half melanic (laterally) and half yellow (medially).

Description. Holotype female.

Body length. 6.12 mm

Head. OOL 0.13; POD 0.15; IOL 0.09; EH 0.88; MS 0.16; 38 (38–40) flagellomeres.

Mesosoma. Mesoscutum punctate; notauli well impressed and crenulate; scutellum with apical carina and subapical transverse depression; sternaulus well impressed and crenulate, extending about ¾ length of mesopleuron; metapleuron rugose in ventral 1/3, punctate dorsally; fore tibial spur as long as basitarsus.

Metasoma. Median tergite 1 about twice as long as wide apically (length = 0.94mm, width = 0.48mm).

Color. Yellow, except as follows: flagellum melanic, scape melanic in lateral half, yellow in medial half, pedicel melanic; tip of hind tibia black, hind tarsomeres mostly black but each paler basally, hind tibial spurs yellow to pale brown. Fore wing weakly infumate in distal half and in a longitudinal stripe basad stigma, veins yellow basally,

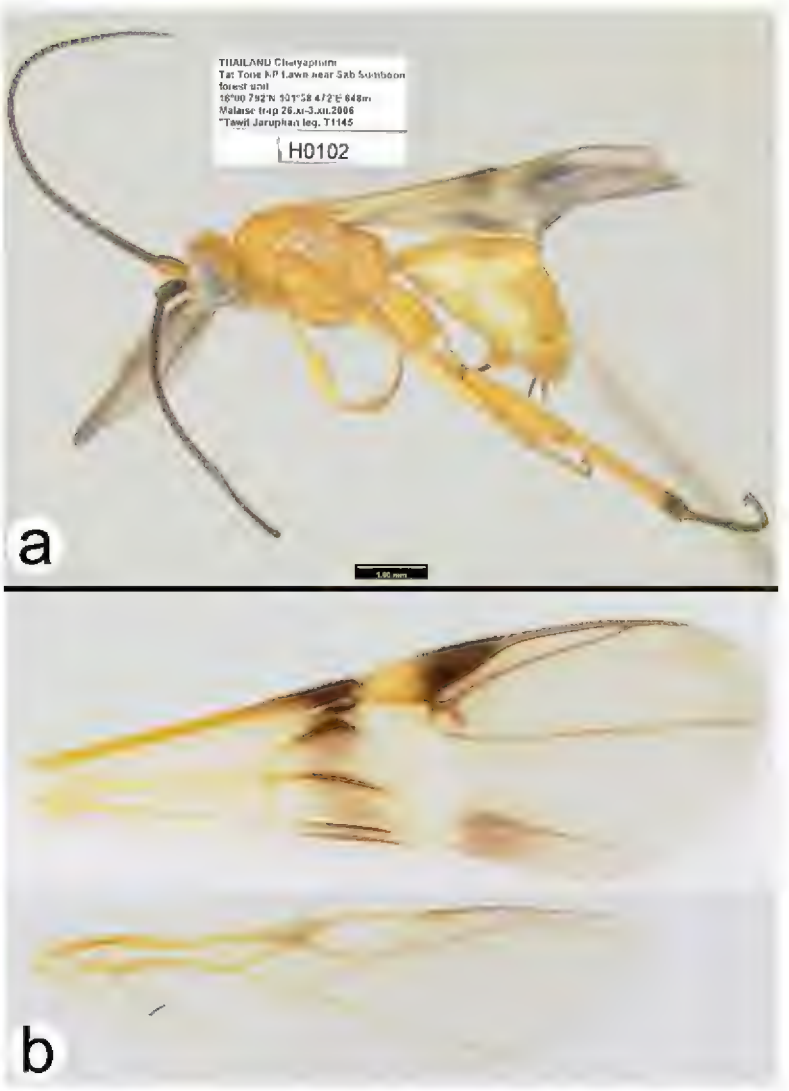


Figure 33. *Coccygidium mastigon* **a** lateral habitus **b** wings.

Figure 34. *Coccygidium mastigon* **a** lateral head and mesosoma **b** dorsal head and mesoscutum **c** dorsal propodeum and metasomal tergum 1.

melanic where the membrane is weakly melanic; stigma yellow in basal half, vein R pale from stigma to union with RS. Hind wing hyaline with yellow veins.

Male. Eyes smaller than those of female. OOL 0.17; POD 0.15; IOL 0.11; EH 0.79; MS 0.23; 40 flagellomeres.

GenBank accessions. *H102:* #HQ667977. *H680:* #HQ667962.

Distribution. Known only from Thailand. Distribution map can be found at http://purl.org/thaimaps/mastigion.

Etymology. *Mastigion* is the diminutive form of the Greek word *mastix*; it is a reference to the short flagellum of this species.

Material examined. Holotype female: H102, Thailand, Chaiyaphum, Tat Tone NP, lawn near Sab Somboon forest unit, 16.013°N 101.975°E, 648m, MT, 26.xi-3.xii.2006, Tawit Jaruphan [QSBG], Paratype male: H680, Thailand, Chaiyaphum, Tat Tone NP, 15.9586°N 101.9073°E, MT, 12–19.iv.2007, Tawit Jaruphan & Orawan Budsawong [HIC].

Coccygidium phaeoscapos Sharkey, sp. n.

urn:lsid:zoobank.org:act:C35E0315-D198-46D3-9511-205DB307F497
http://species-id.net/wiki/Coccygidium_phaeoscapos
Figs 35–36

Diagnosis. Fore wing melanic distally with a melanic spot near parastigma. Scape entirely melanic or with some weak pale infusions medially.

Description. Holotype female.

Body length. 7.1 mm

Head. OOL 0.17; POD 0.17; IOL 0.12; EH 1.04; MS 0.18; 42 flagellomeres.

Mesosoma: Mesoscutum punctate; notauli well impressed and crenulate; scutellum with apical carina and subapical transverse depression; sternaulus well impressed and crenulate, extending about ¾ length of mesopleuron; metapleuron rugose in ventral 1/3, punctate dorsally; fore tibial spur distinctly longer than basitarsus.

Metasoma. Median tergite 1 about twice as long as wide apically (length = 1.11mm, width = 0.59 mm).

Color. Yellow except as follows: flagellum melanic, scape entirely melanic or rarely with some weak pale infusions medially, pedicel melanic; tip of hind tibia varying from black to brown, hind tarsomeres varying from dark yellow to black, hind tibial spurs yellow to pale brown. Fore wing infumate in distal half and with a dark spot near parastigma, veins yellow basally, melanic distally; stigma yellow in basal half, vein R pale from stigma to union with RS. Hind wing yellowish hyaline basally and distinctly melanic distally.

Male. Unknown.

GenBank accessions. *H265:* #HQ667965. *H266:* #HQ667964. *H267:* #HQ667967. *H342:* #HQ667966. *H560:* #HQ667968. *H671:* #HQ667963.

Distribution. Known only from Thailand. Distribution map can be found at http://purl.org/thaimaps/phaeoscapos.

Figure 35. *Coccygidium phaeoscapos* **a** lateral habitus **b** wings.

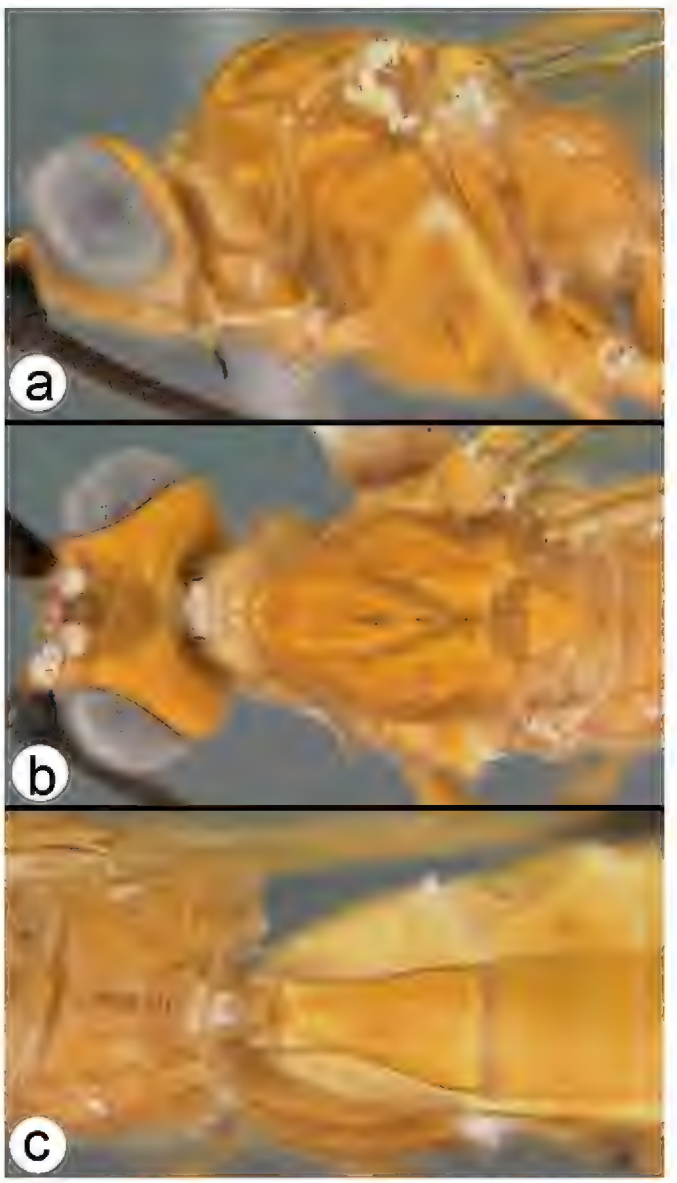


Figure 36. *Coccygidium phaeoscapos* **a** lateral head and mesosoma **b** dorsal head and thorax **c** dorsal propodeum and metasomal terga 1 and 2.

Etymology. From the Greek *phaios* meaning dusky or brown, and *scapos*; this is a reference to the dark scape which distinguishes this species.

Material examined. Holotype female: H267, Thailand, Ubon Ratchathani, Pha Taem NP,Phu Krajeaw foothill 15.667°N 105.508°E 246m MT 2–9.vi.2007 Tongcam & Banlu [QSBG].

Paratypes ♀: Thailand: H671, Chaiyaphum, Pha Hin Ngam NP, deciduous forest/ Tepa Waterfall, 15.649°N 101.418°E, 614m, MT, 19–25.iv.2007, Katae Sa-nog & Buakaw Adnafai [QSBG]; H265, Chaiyaphum, Pa Hin Ngam NP, deciduous forest, 15.666°N 101.453°E, 357m, MT, 13–19.vi.2007, Katae Sa-nog & Buakaw Adnafai[HIC]; H342, Loei, Phu Kradueng NP, Mixed deciduous/S Na Noy office 16.817°N 101.794°E, 276m, MT, 14–21.v.2008, Thonghuay Phatai; H266, Sakon Nakhon, Phu Phan NP16.81°N 103.892°E, 512m, MT, 16–22.vi.2007, Winlon Kongnara [QSBG]; H631, Tat Tone NP, 16°0.79N 101°58.472E, 648m, MT, 12–19.v.2007, Jaruphan & Budsawong [QSBG]; H553 & H560, Chaiyaphum, Tat Tone NP, Dipterocarp forest at Sapsomboon substation 16.018°N 101.977°E, 674m, MT, 19–26.v.2007, Tawit Jaruphan & Orawan Budsawong [QSBG, HIC]; H306, Chaiyaphum, Tat Tone NP, Dipterocarp forest at Sapsomboon substation, 16.043°N 101.977°E, 675m MT, 5–12.v.2007, Tawit Jaruphan & Orawan Budsawong [QSBG]; H395 & H398, Chaiyaphum, Tat Tone NP, Dipterocarp forest at Sapsomboon substation, 16.043°N 101.977°E, 675m, MT, 26.v.-2.vi.2007, Tawit Jaruphan & Orawan Budsawong [QSBG, HIC].

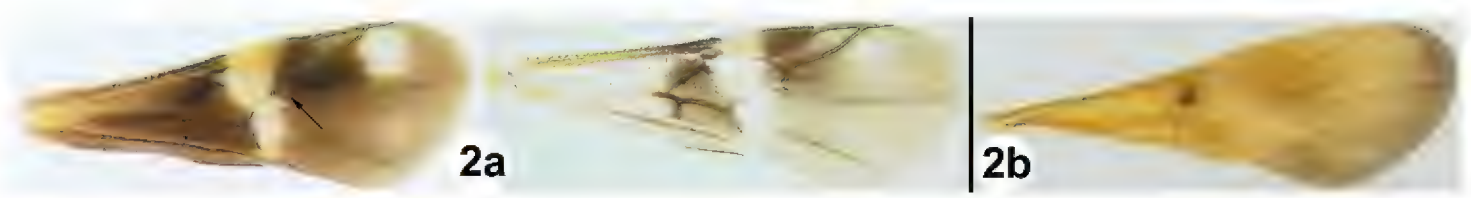
Key to Thai Species of *Cremnops*

1a Metasoma and hind leg mostly or entirely pale **2**

1b Metasoma and hind leg mostly or entirely melanic ..... ***C. fuscipennis* Brullé**

2a Fore wing variable but never as in 2b and usually with a yellow stigma area and two or three pale bands ..... ***C. desertor* (Linnaeus)**

2b Fore wing mostly deep yellow with the distal edge infumate and a small infumate patch below the parastigma (The latter may be variable.) ..... ***C. mekongensis* Turner**



***Cremnops desertor* (Linnaeus)**
http://species-id.net/wiki/Cremnops_desertor
Fig. 37

Ichneumon desertor Linnaeus 1758.
Agathis atricornis Smith 1874. Synonymized by Sharkey 1996. [BMNH, examined]
Bracon deflagrator Spinola 1808. Synonymized by Curtis 1837. [type presumably lost]
Cremnops alternans Enderlein 1920. Synonymized by Sharkey 1996. [MZPW, examined].
Cremnops lemniscatus Enderlein 1920. Synonymized by Sharkey 1996. [MZPW, examined].
Cremnops malayensis Bhat 1979. syn. n. [FSCA, examined]
Agathis nigritarsus Cameron 1899. syn. n. [OUMNH, examined], India.
Ichneumon purgator Fabricius 1793. Synonymized by Latreille1805. [type presumably lost]

Diagnosis. This is a highly variable and widespread species. The fore wing varies from completely infuscate to mostly hyaline with dark and yellow bands. The images in the key (above) show a good range of variation. The combination of characters given in the key is sufficient to identify Thai specimens.

Notes. Contrary to van Achterberg and Long (2010) we do not recognize the species status of *C. atricornis* (Smith) but rather consider it to be a junior synonym of *C. desertor*. The character that van Achterberg and Long used to separate eastern and western specimens of *C. desertor* is the relative lengths of the fore tibia and tarsus. The first two specimens that we checked from Thailand fit their concept of the West Palearctic forms, and looking at all specimens from a large number of Oriental specimens the measurements are variable with no clear gap between long and short. *Cremnops desertor* has recently been found in North America. There is one specimen from Ottawa, Canada and one from Washington DC. These are in the Canadian National Collection in Ottawa and the US National Museum in Washington, respectively. Among the specimens of *C. desertor* from Thailand one was particularly small, *i.e.*, 5.4 mm rather than the average length of 6.8 mm. 28S sequence data of several specimens, including the smallest, were identical (Fig. 2). A recently collected specimen of *C. desertor* from Sweden differed in only 4 positions (~600 bps total) from the two Thai specimens that were checked (Fig. 2). The specimen of *C. mekongensis*, which is very similar morphologically to *C. desertor*, differed in 11 sites in the 28S rDNA (Fig. 2). There is no magic number as to how many site changes constitute a distinct species but we predict that as 28S sequence data are obtained for specimens of *C. desertor* from sites between Europe and Thailand that there will be a grade in the 4 sites in which the 28S sequences differ.

GenBank accession. *H098:* #JF506256. H8099: #JN019810. H294: #JN019811

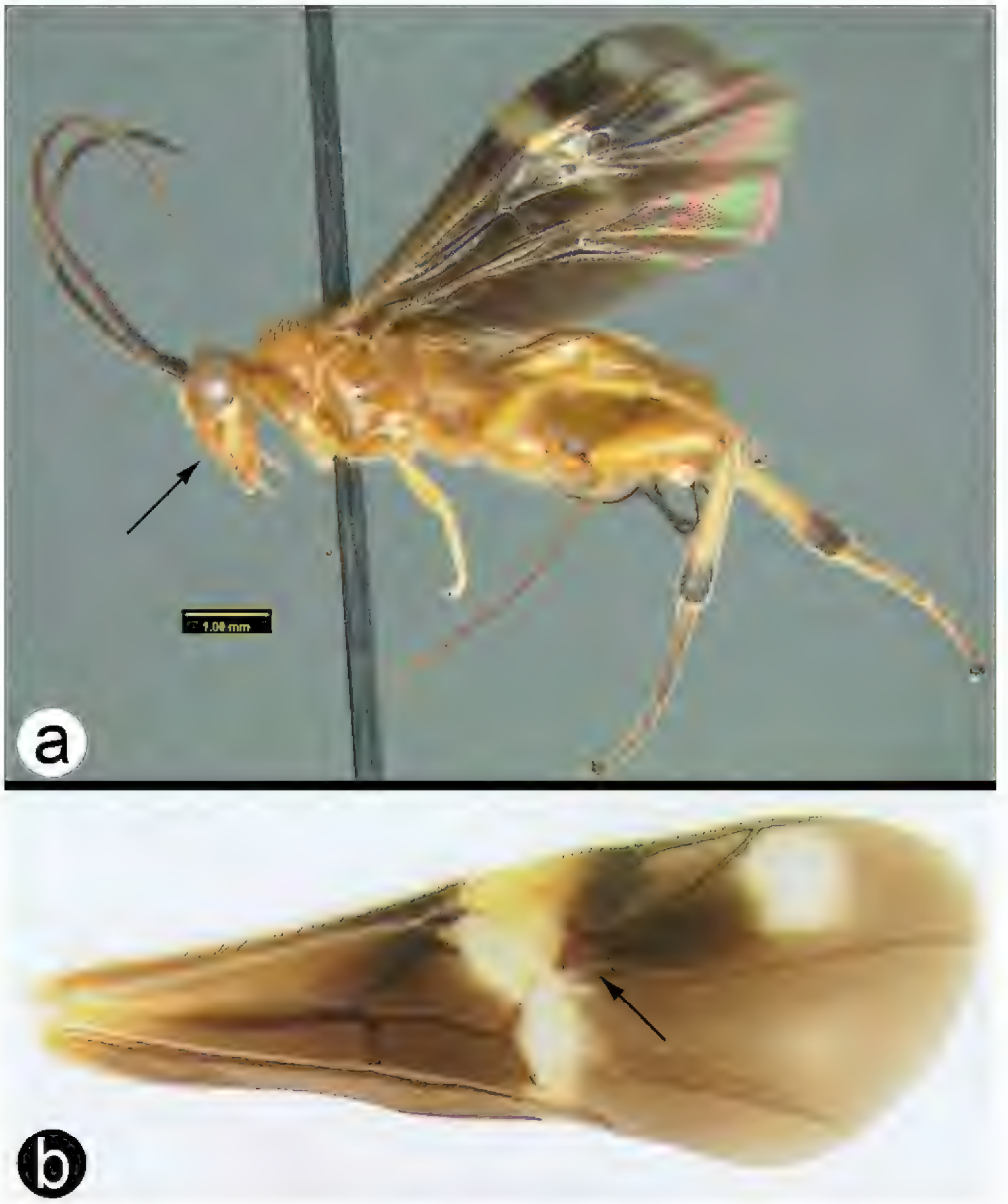


Figure 37. *Cremnops desertor* **a** lateral habitus **b** fore wing.

Distribution. Widespread over temperate and tropical Eurasia and, recently, accidentally introduced to eastern North America. Distribution map of Thai and Peninsular Malaysia specimens can be found at http://purl.org/thaimaps/desertor.

Examined specimens are in the following collections: BMNH, HIC, QSBG, CNC and UKM.

***Cremnops fuscipennis* (Brullé)**
http://species-id.net/wiki/Cremnops_fuscipennis
Fig. 38

Agathis fuscipennis Brullé 1846. [MNHN, examined], Indonesia, Java.
Cremnops persimillis Szépligeti 1908. Synonymized by Bhat 1979. [HNHM], Indonesia, Java.

Diagnosis. Fore wing evenly and darkly infuscate, with or without a small clear patch posterior to the stigma; hind leg and metasoma black; head yellow with black vertex,

mesosoma yellow except metathorax and propodeum which vary from yellow to black; notauli smooth and weakly impressed, especially anteriorly.

Notes. Very similar to *Cremnops collaris* Ashmead 1904, the type of which is from the Philippines, and *Cremnops indicus* Bhat 1979, from India. The three nominal species may represent one variable widespread species. The only obvious differences are minor variation in body color and wing color pattern.

Distribution. Examined specimens are from Java and Peninsular Malaysia. Literature records are only from Java. Although the species has not been recorded in Thailand it is included here due to the likelihood that its range extends into southern Thailand. Distribution map of Peninsular Malaysia specimens can be found at http://purl.org/thaimaps/fuscipennis.

Examined specimens are in the following collections: BMNH, HIC, and UKM.

Cremnops mekongensis Turner, 1919

http://species-id.net/wiki/Cremnops_mekongensis
Figs 39–40

Cremnops mekongensis Turner 1919 [BMNH, type examined] Laos.

Diagnosis. Easily distinguished from other species by body and/or fore wing color. This is only the second specimen of the species collected, the other being the holotype.

GenBank accession. *H470:* #HQ667976

Distribution. Thailand and Laos. Distribution map of the sole Thai specimen deposited in HIC can be found at http://purl.org/thaimaps/mekongensis.

Cremnoptoides yui Sharkey, sp. n.

urn:lsid:zoobank.org:act:A118E588-FD32-49E4-AC32-A9D47FCB2CFB
http://species-id.net/wiki/Cremnoptoides_yui
Figs 41–42

Diagnosis. This is the only species of *Cremnoptoides* that is not almost entirely black. The other two species, *C. furcatus* and *C. pappi*, do not have the extensive yellow coloration present in *C. yui*. For descriptions of the other two species see van Achterberg and Chen (2004).

Description. Holotype female.

Length. 7.0 mm.

Head. Antenna with 40 flagellomeres; head slightly elongate; frons with sharp lateral carinae extending to lateral ocelli.

Mesosoma. Sternaulus weakly impressed with elongate transverse, shallow carinae extending the length of the mesopleuron; metapleuron aciculate to rugose and moderately setose; propodeum areolate with a spindle-shaped medial cell; propodeum moderately setose except medial cell; hind trochantellus with longitudinal carina, medial and lateral

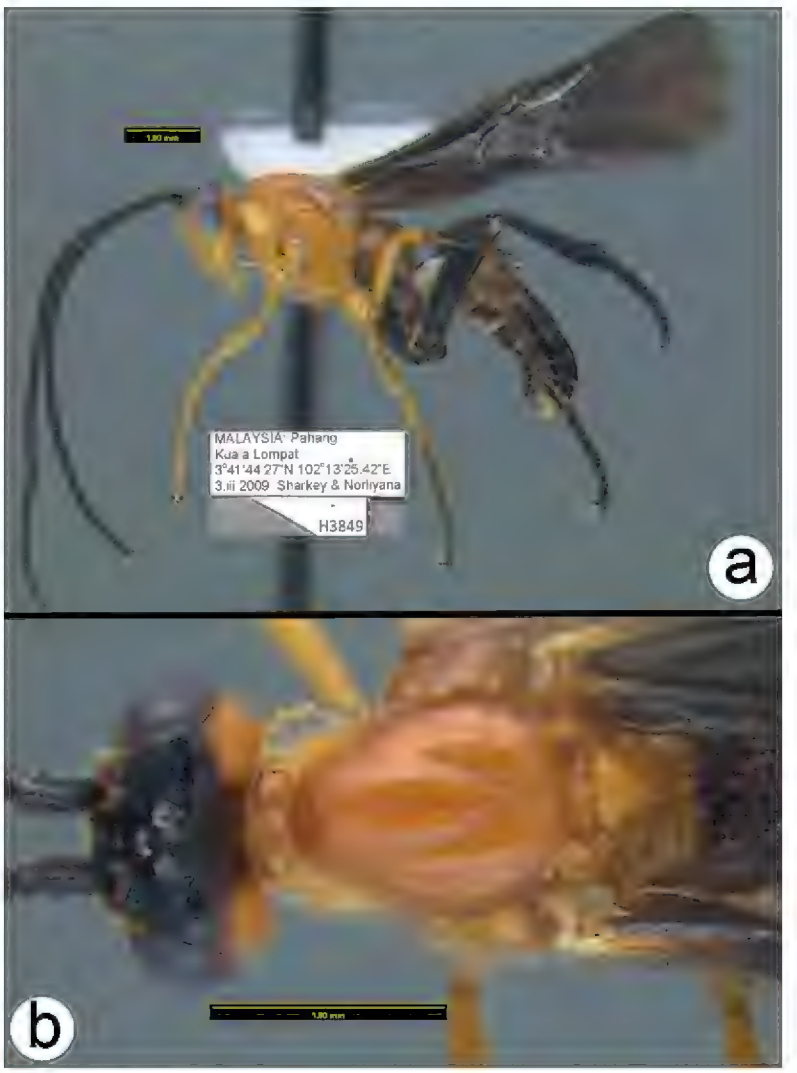


Figure 38. *Cremnops fuscipennis* **a** lateral habitus **b** dorsal head and thorax.

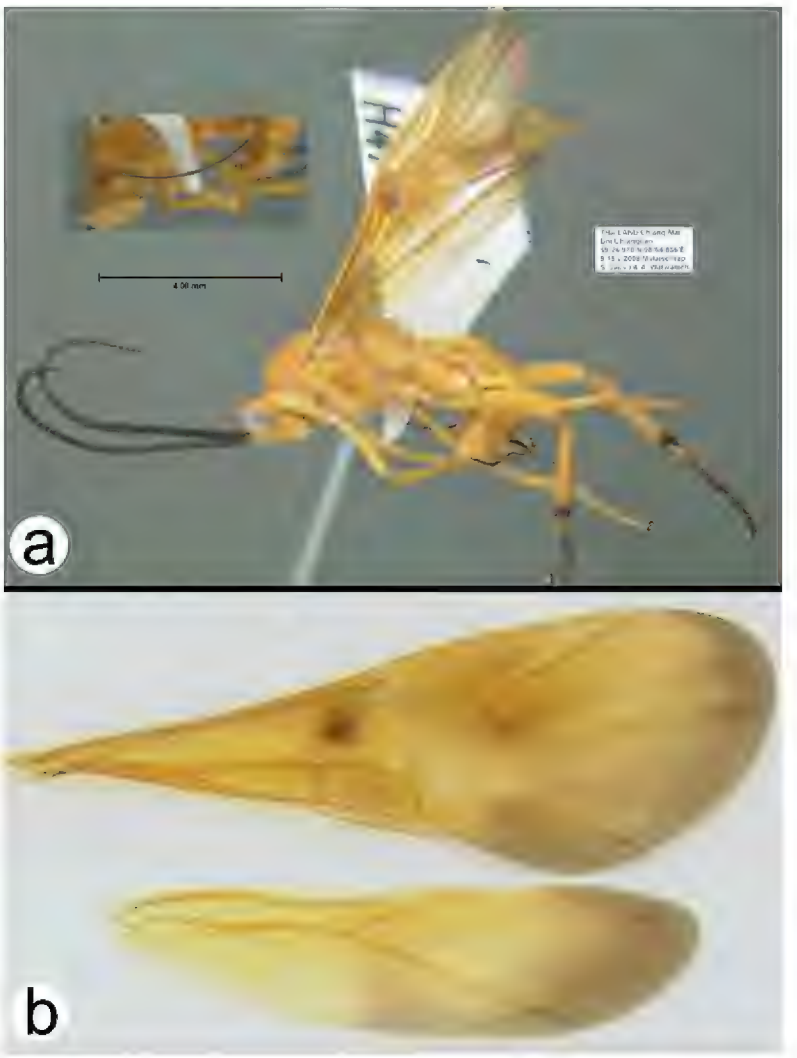


Figure 39. *Cremnops mekongennsis* **a** lateral habitus, inset showing ovipositor length **b** wings.

Figure 40. *Cremnops mekongennsis* **a** anterior head **b** lateral head and mesosoma **c** dorsal thorax **d** dorsal propodeum and metasomal tergum 1.

hind claws both with a right-angled or slightly acute basal lobe, hind femur aciculate; mid tibia with one peg; hind tibia with 3 pegs; last abscissa of RS of fore wing sinuate.

Metasoma. Metasomal tergum 1 with a smooth transverse groove; border between tergum 2 and 3 marked by a smooth transverse groove; ovipositor slightly shorter than body length.

Male. Essentially as in the holotype.

Variation. The holotype is representative of darker specimens. Other specimens may have more extensive yellow color on the metasomal tergites and the flagellum may be pale brown, almost dark yellow.

Distribution. Known only from the above localities in Thailand. Distribution map can be found at http://purl.org/thaimaps/yui.

Etymology. Named in honor of Dr. Dicky Yu, for his immense contributions to hymenopterology.

Material examined. Holotype female: H039, Thailand, Phitsanulok, Thung Salaeng Luang NP, Mixed deciduous forest (Gang Sopa waterfall), Malaise trap, 4–12. xi.2006, Pongpitak Pranee, [QSBG].

Paratypes: Thailand: 1♀, H1182, Chiang Mai, Pa Huay Tong Moo 8 Tambon Bo Luang, 1–20.ix.1997, S. Sonthichai, [HIC]; 2♀♀, H1183 & H1184, Loei, Phu Kradueng NP, Huay Lao Kao, Malaise trap, 9–16.viii.2006, Sutin Khonglasae, [HIC, QSBG]; 2♀♀, H632 & H644, Phetchabun, Nam Nao NP, Check point, Malaise trap, 5–12.v.2007, Noopean Hongyothi, [HIC]; 1♀, H681, Suphanburi,

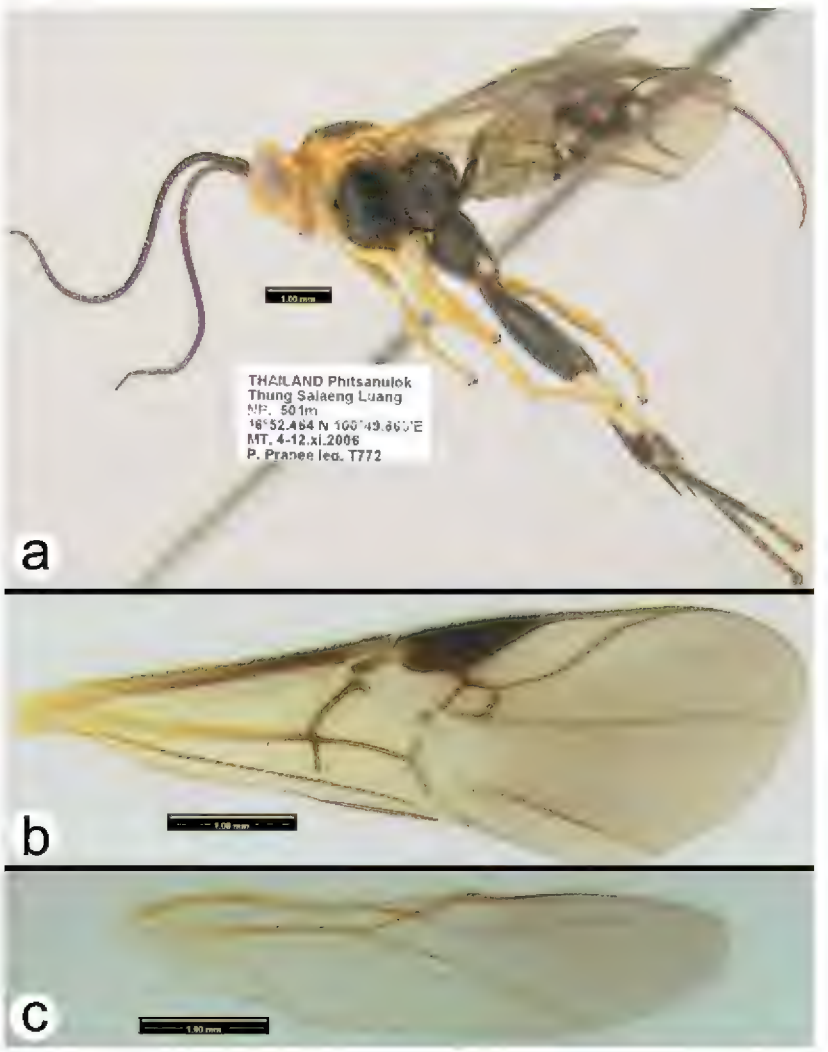


Figure 41. *Cremnoptoides yui* **a** lateral habitus **b** fore wing **c** hind wing.

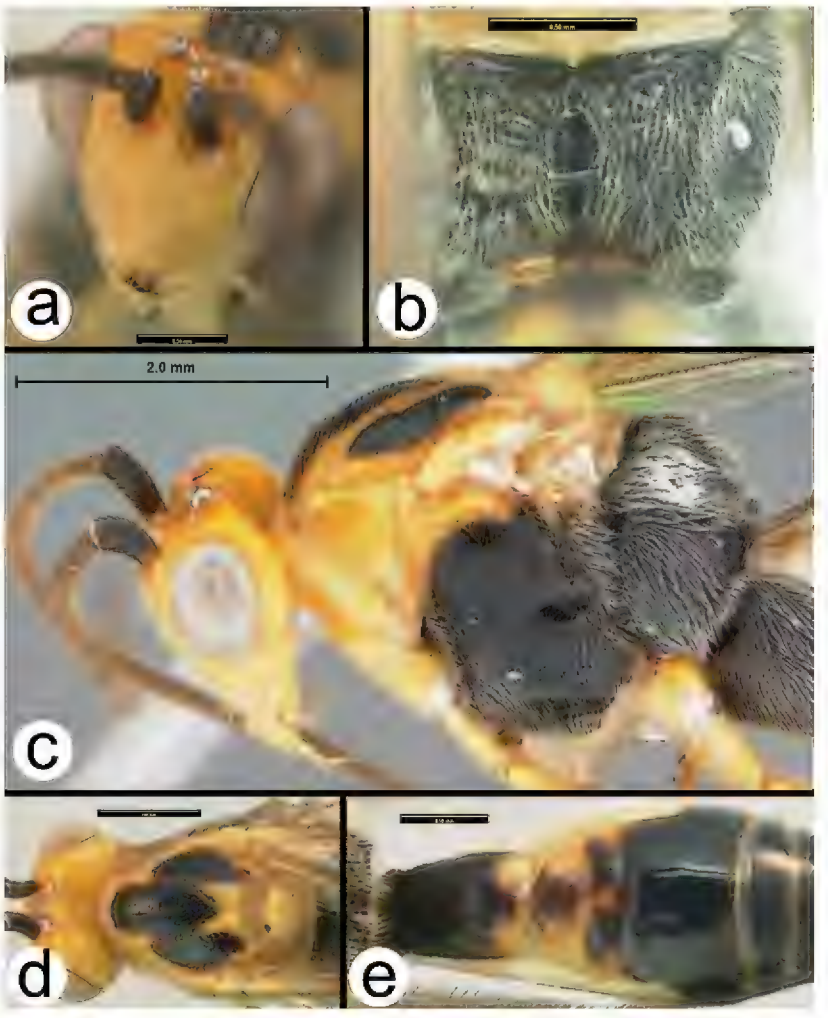


Figure 42. *Cremnoptoides yui* **a** anterodorsal head **b** dorsal propodeum **c** lateral head and mesosoma **d** dorsal head and thorax **e** dorsal metasomal terga 1–4.

Pu Toei NP, Phu Toei hill top/road, Malaise trap,1–8.viii.2008, Saunbua. L. , [QSBG]; 1♀, H1185, Ubon Ratchathani, Pha Taem NP, Don Huay Can, Malaise trap, 9–15.vi.2007, Tongcam & Banlu, [QSBG]; 1♀, H1181, Ubon Ratchathani, Pha Taem NP, Huay Sa Nhom plateau, Malaise trap, 11–18.xi.2006, Sorawit and Thongdee, [QSBG]; 1♂, H1186, Ubon Ratchathani, Pha Taem NP, Kua nang nee, Malaise trap, 25.viii-2.ix.2006, Bunlu Subsiri, [HIC]; 1♀, H766, Ubon Ratchathani, Pha Taem NP, Phu Krajeaw foothill, Malaise trap, 9–15.vi.2007, Tongcam & Banlu, [HIC]; 1♀, H001, Chaiyaphum Tat Tone NP, Malaise Trap, 12–19.x.2006, Tawit Jaruphan, [HIC].

Key to Thai Species of *Disophrys*

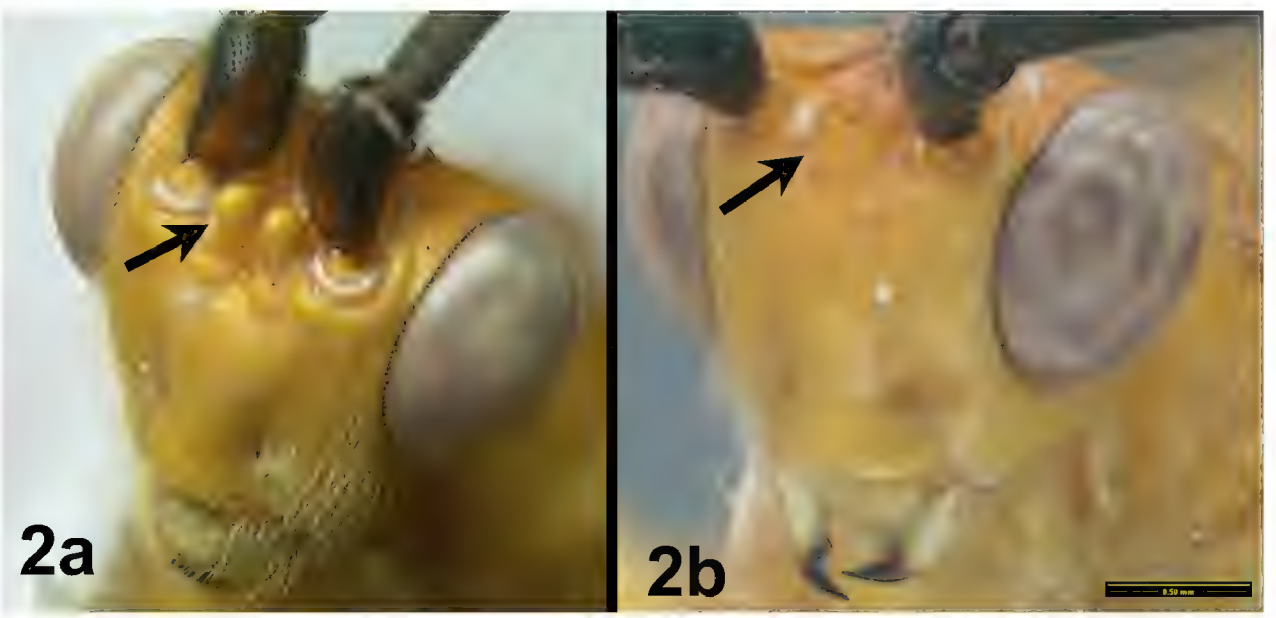
1a Mesoscutum yellow with a black spot on each lobe; notauli with wide crenulations ..... ***D. strigata*** **Enderlein**

1b Mesoscutum reddish orange; notauli with wide crenulations ..... ***D. erythrocephala*** **Cameron**

1c Mesoscutum yellow; notauli without wide crenulations **2**

2a Blunt tubercles between antennae ..... ***D. rhinoides*** **van Achterberg & Long**

2b Sharp carinae between antennae..... ***D. subfaciata*** **(Brullé)**



***Dispophrys erythrocephala* Cameron**
http://species-id.net/wiki/Dispophrys_erythrocephala
Figs 43–44

Dispophrys erythrocephala Cameron 1900 [OUMNH, type examined] Indonesia (Sumatra)

Diagnosis. The color of this species is unique to *Disophrys* in the region.

GenBank accession. *H090:* #HQ667971

Distribution. Thailand, Vietnam, China, Taiwan, India, Sri Lanka, Peninsular Malaysia and Indonesia (Sumatra, Krakatau, Kangean Islands) (van Achterberg and Long 2010). Distribution map of the Thai specimens can be found at http://purl.org/thaimaps/erythrocephala.

Identified specimens are deposited in HIC and QSBG.

***Disophrys rhinoides* van Achterberg & Long**
http://species-id.net/wiki/Disophrys_rhinoides
Figs 45–46

Disophrys rhinoides van Achterberg and Long 2010 [RMNH, type examined] Vietnam.

Diagnosis. The rounded protuberances between the antennae are unique.

GenBank accession. *H007:* #HQ667970

Distribution. Vietnam and Thailand. Distribution map of the Thai specimens can be found on http://purl.org/thaimaps/rhinoides.

Identified specimens are deposited in HIC and QSBG.

***Disophrys strigata* Enderlein**
http://species-id.net/wiki/Disophrys_strigata
Fig. 47

Disophrys strigata Enderlein 1920 [MZPW, type examined] Indonesia, Sumatra.
Disophrys macilifera van Achterberg and Long 2010 syn. n. [RMNH, type examined] Vietnam.

Diagnosis. The general color pattern and the wide crenulae on the notauli are sufficient to distinguish this species.

Notes. Van Achterberg and Long (2010) described *D. maculifera* as a distinct species based on the following distinctions. "*Disophrys strigata* differs by having the hind leg completely black (*Disophrys maculifera* has at least hind coxa, trochanter and trochantellus yellowish ventrally), fore coxa with a black patch, middle of mesopleuron and dorsal third of metapleuron and propodeum medially

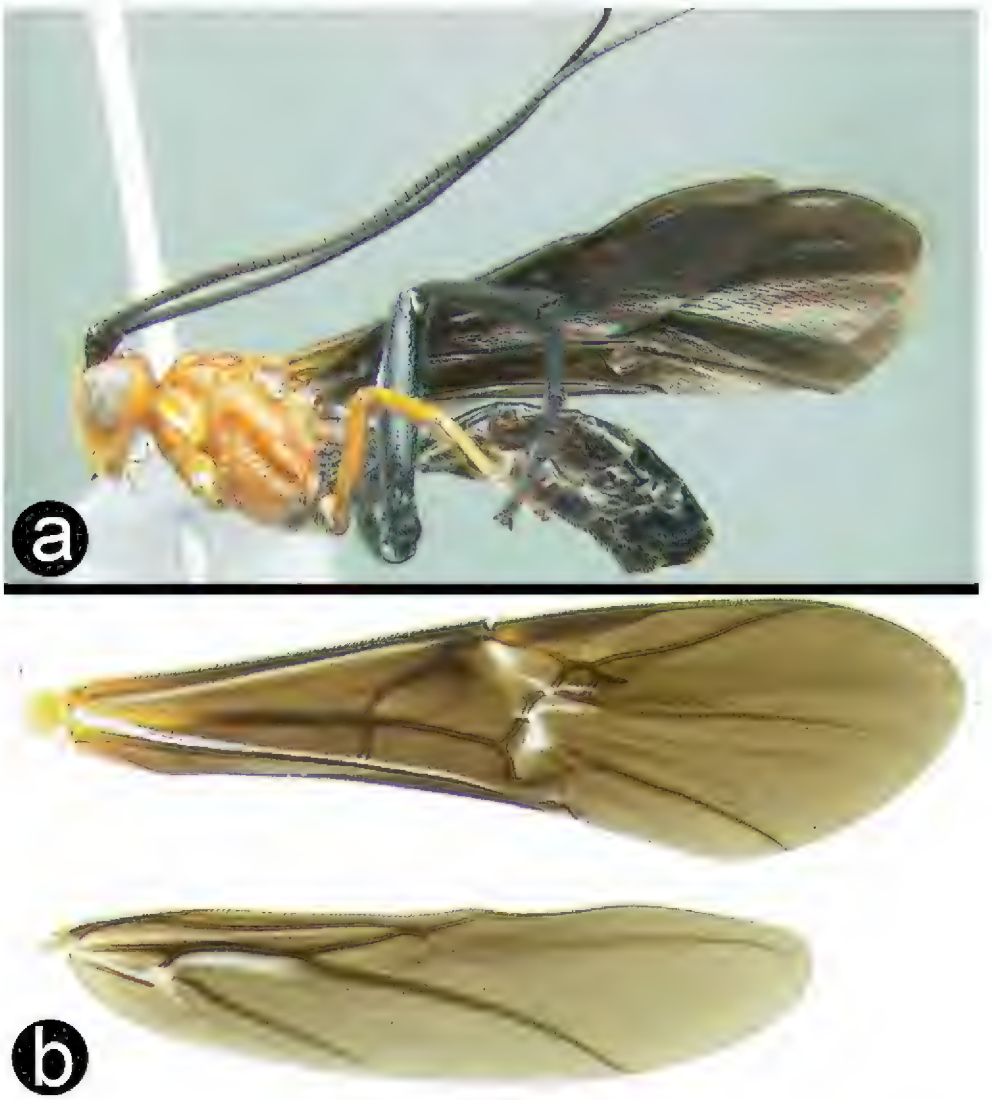


Figure 43. *Disophrys erythrocephala* **a** lateral habitus **b** wings.

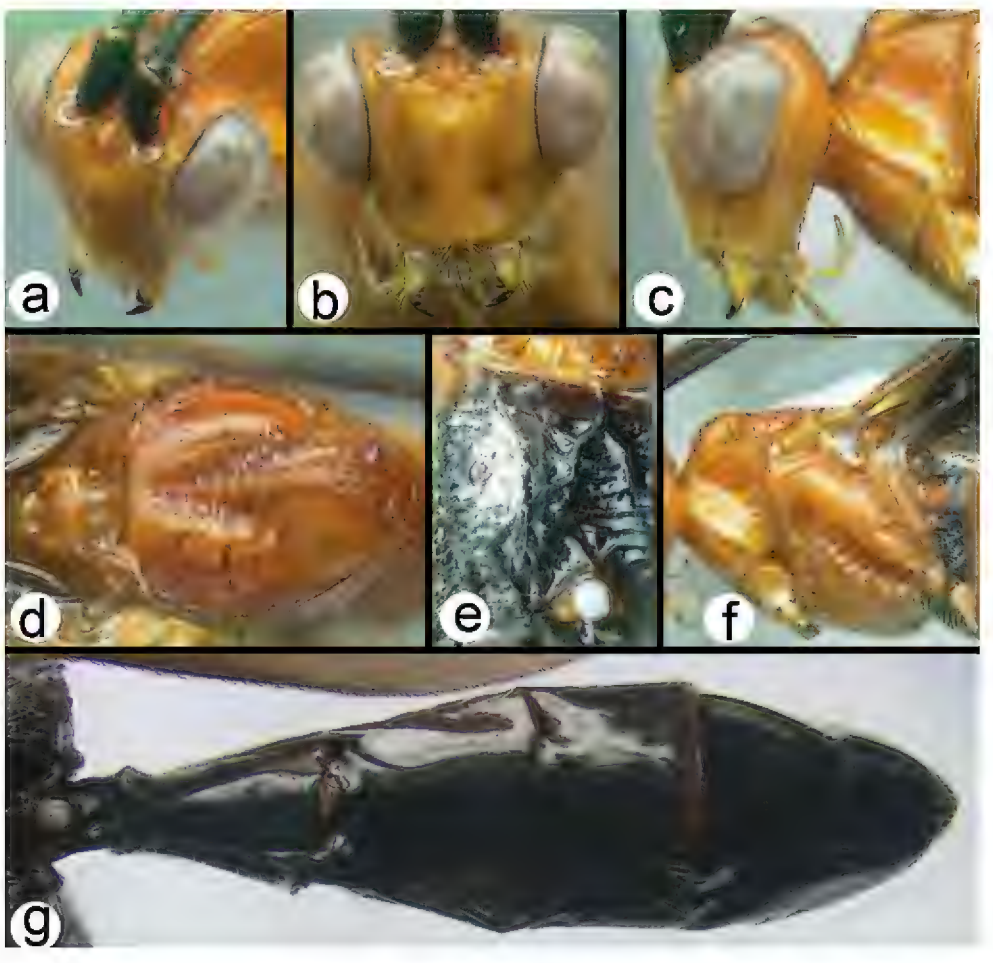


Figure 44. *Disophrys erythrocephala* **a** dorsolateral head **b** anterior head **c** lateral head and prothorax **d** dorsal mesothorax **e** dorsal propodeum **f** lateral pro- and mesothorax **g** dorsal metasoma.

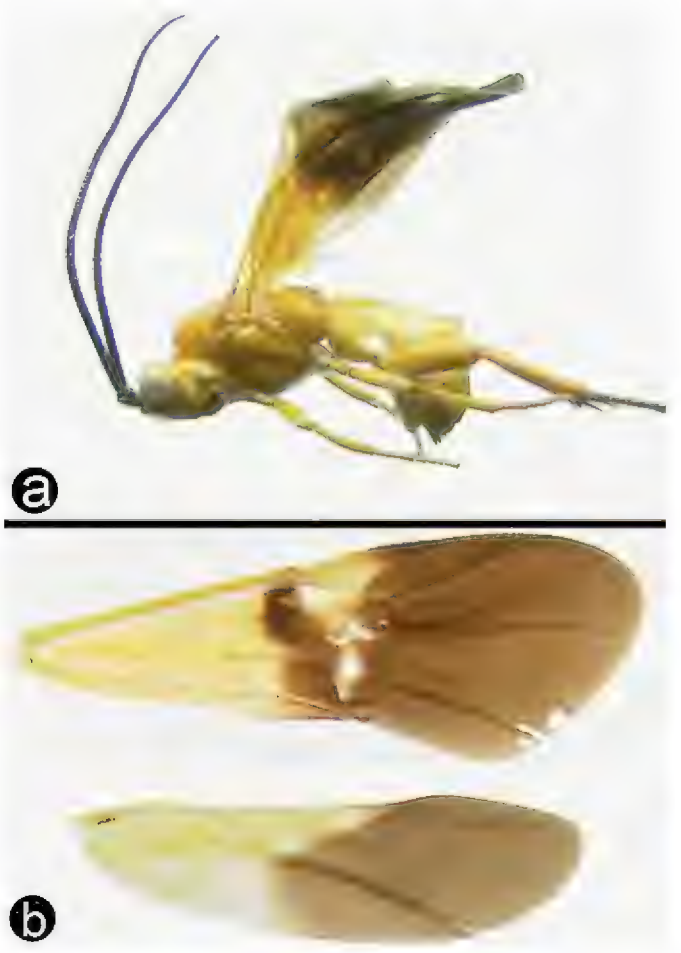


Figure 45. *Disophrys rhinoides* **a** lateral habitus **b** wings.

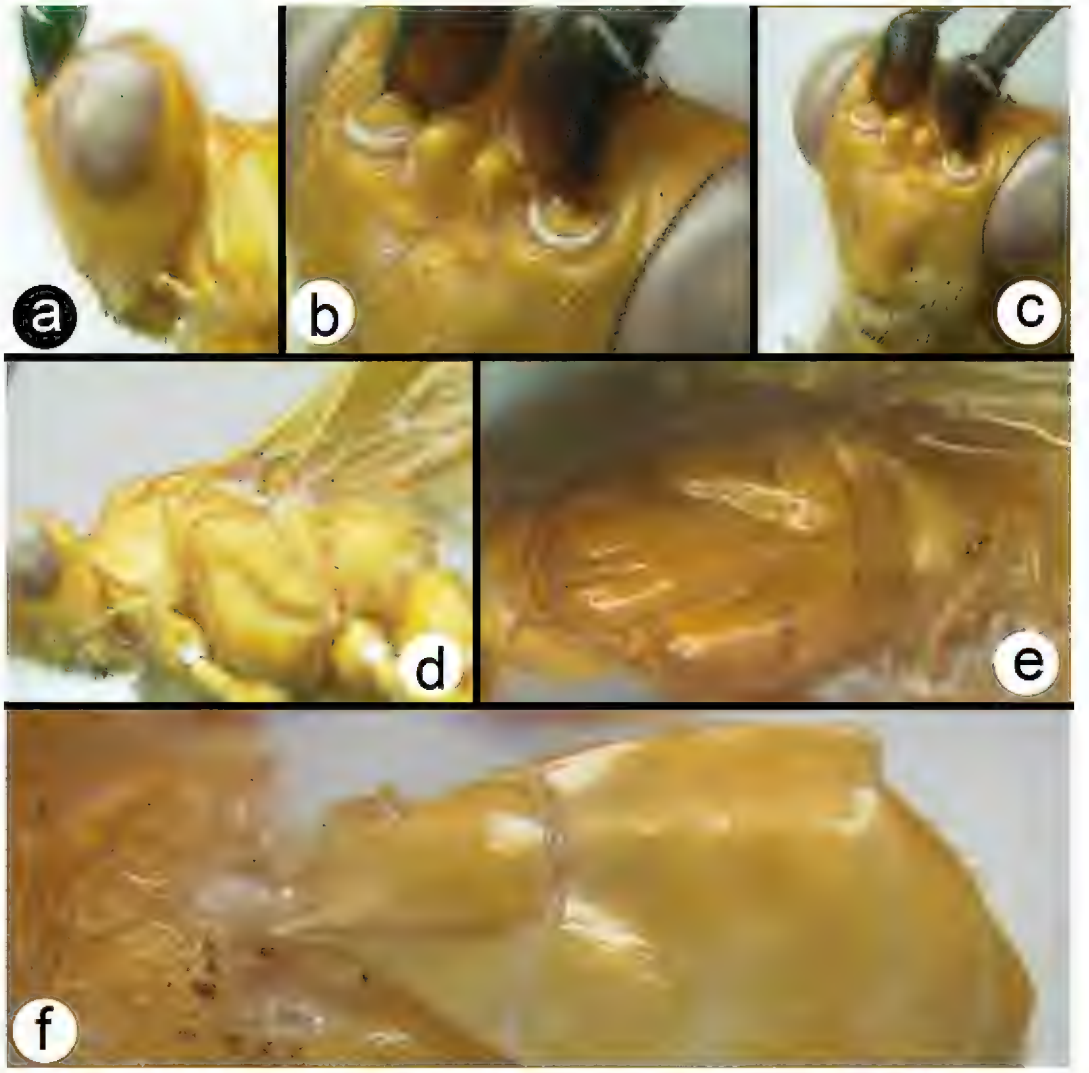


Figure 46. *Disophrys rhinoides* **a** lateral head **b** anterodorsal head showing closeup of interantennal region **c** anterodorsal head **d** lateral head and mesosoma **e** dorsal mesosoma **f** dorsal propodeum and metasoma.

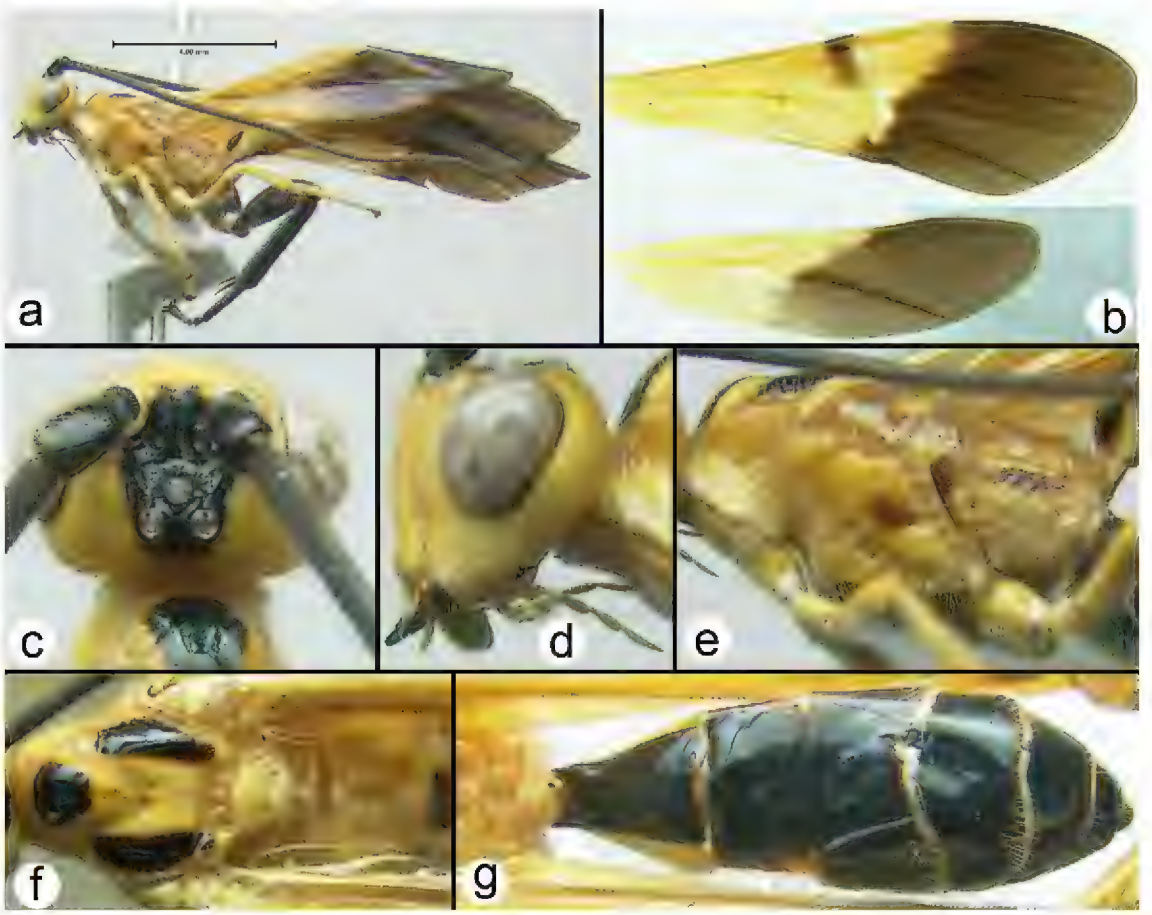


Figure 47. *Disophrys strigata* **a** lateral habitus **b** wings **c** dorsal head **d** lateral head **e** lateral mesosoma **f** dorsal mesosoma **g** dorsal propodeum and metasoma.

black (brownish-yellow in *Disophrys maculifera*)." Contrary to the preceding, the ventral surface of the hind coxa is yellow in the type of *D. strigata*. However the major reason for synonymizing the two is that the Thai specimens are intermediate in coloration between the Vietnamese (*D. maculifera*) and Sumatran (*D. strigata*) specimens, which is what one would expect if they represent the same species. For example, the Thai specimens have yellow on the hind coxa and femur ventrally, agreeing with *D. maculifera*, and the metasomal median tergites are entirely black, agreeing with *D. strigata*.

This species is very similar to *Disophrys insignis* Roman, 1913 from the Philippines but differs in that the latter has much shallower notauli and the lateral carinae of the frons are much higher than those of *D. macilifera*. They are undoubtedly closely related in that the pattern of the propodeal carinae is unlike those of other *Disophrys*. Normally the medial cell of the propodeum is greatly expanded anteriorly and laterally, however in these two species it is in the form of a small pentagon. The Thai specimens are somewhat darker than those of Vietnam.

GenBank accession. *H006:* # HQ667969

Distribution. Indonesia, Vietnam, Thailand. Distribution map of the Thai specimens can be found at http://purl.org/thaimaps/strigata.

Identified specimens are deposited in HIC and QSBG.

***Disophrys subfaciata* (Brullé)**
http://species-id.net/wiki/Disophrys_subfaciata
Figs 48–49

Agathis subfaciata Brullé, 1846 [MNHM, type examined] India
Disophrys quymanhi van Achterberg and Long 2010. syn. n. [RMNH, type examined] Vietnam.

Diagnosis. The color patterns, the relatively smooth notauli, and the sharp ridges between the antennae are sufficient to distinguish this species.

Notes. Van Achterberg and Long (2010) wrote the following concerning the similarity between their new species *D. quymanhi* and *D. subfasciata*, "Similar to *Disophrys subfasciata* (Brullé, 1846) from India, but that species has the scapus partly yellowish (entirely black in *Disophrys quymanhi*), no ramellus (present) and the notauli are deeply impressed (shallow)." Contrary to these comments, the ramellus, or 2RS2 vein of the fore wing, is present in the holotype of *D. subfasciata*. The notauli of the Thai and Vietnamese specimens are deeply impressed and smooth exactly as in the holotype of *D. subfasciata*. The remaining difference is the presence of some yellow on the scape of the holotype of *D. subfasciata* which is absent in the Thai and Vietnamese specimens. In light of the fact that many specimens from India also lack this yellow coloration, and are otherwise identical to the type, we believe it to represent intraspecific variation.

GenBank accession. *H1862:* #JF506257

Distribution. Thailand, India and Vietnam. Distribution map of the Thai specimens can be found at http://purl.org/thaimaps/sybfaciata.

Besides the types, identified specimens are in HIC and QSBG.

***Earinus aurantius* van Achterberg & Long**
http://species-id.net/wiki/Earinus_aurantius
Fig. 50

Earinus aurantius van Achterberg and Long 2010 [RMNH, type examined]

Diagnosis. This species is very similar to *Earinus longensis* Sharkey 1996. The coloration of the Thai specimens match specimens of *E. longensis* (China, Japan and Far East Russia) almost exactly, however specimens of *E. aurantius* are more gracile and their ovipositor sheaths are wider.

Notes. The Thai specimens differ from those described from Vietnam in that the former have less orange brown color on the mesosoma. In the Thai specimens this color is restricted to the apex of the scutellum.

GenBank accession. *H041:* #HQ667972

Distribution. Thailand and Vietnam. Distribution map of the Thai specimens which are deposited in HIC and QSBG can be found at http://purl.org/thaimaps/aurantius.

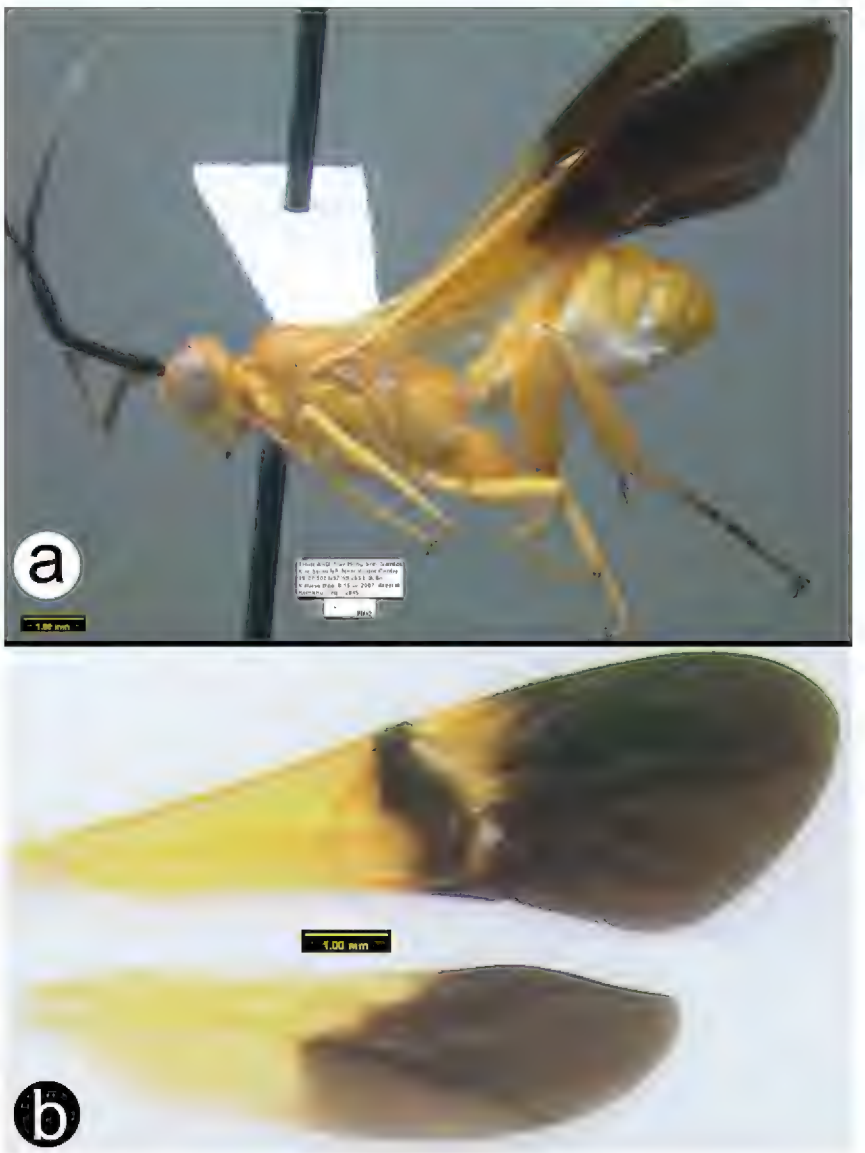


Figure 48. *Disophrys subfasciata* **a** lateral habitus **b** wings.

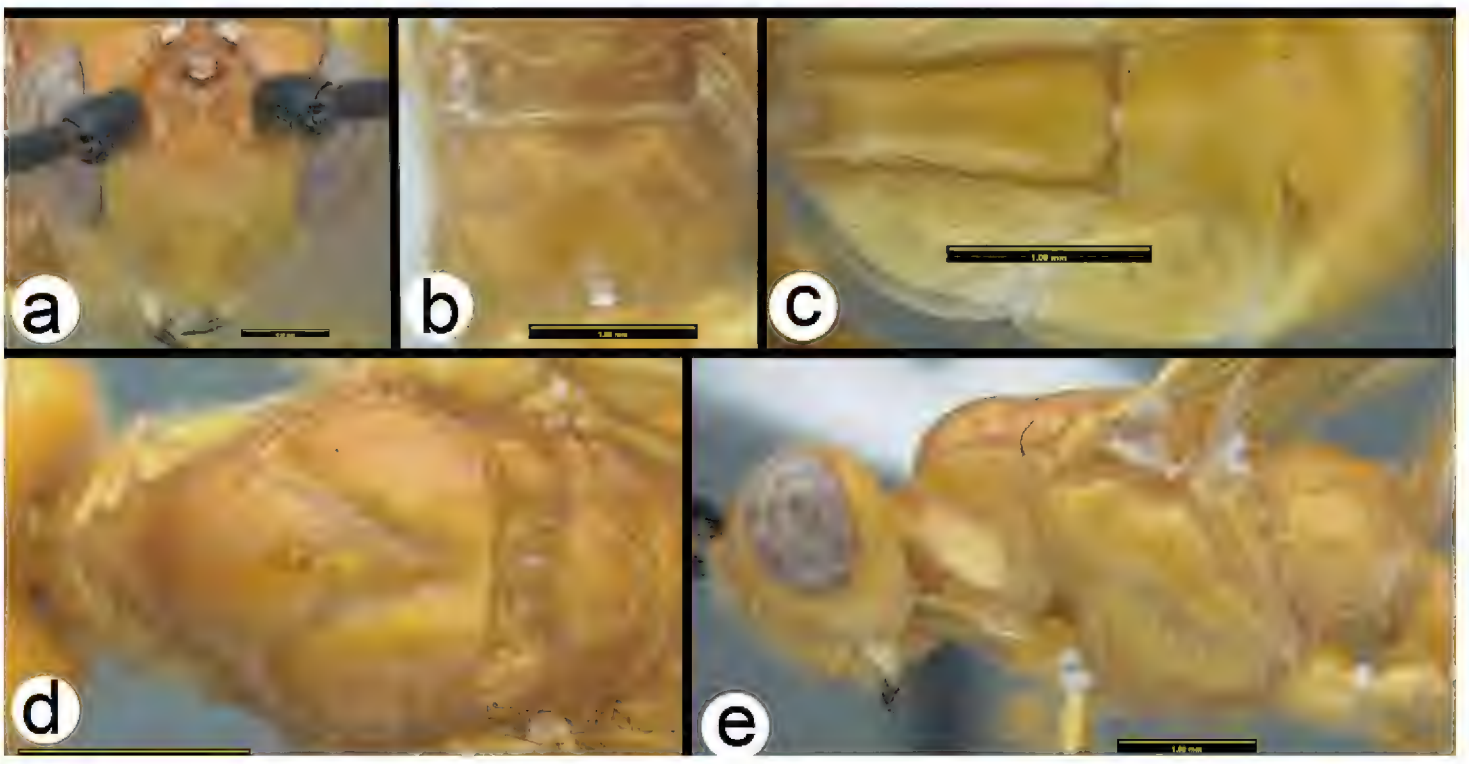


Figure 49. *Disophrys subfasciata* **a** anterodorsal head **b** dorsal metasoma and propodeum **c** dorsal metasomal terga 1–3 **d** dorsal thorax **e** lateral head and mesosoma.

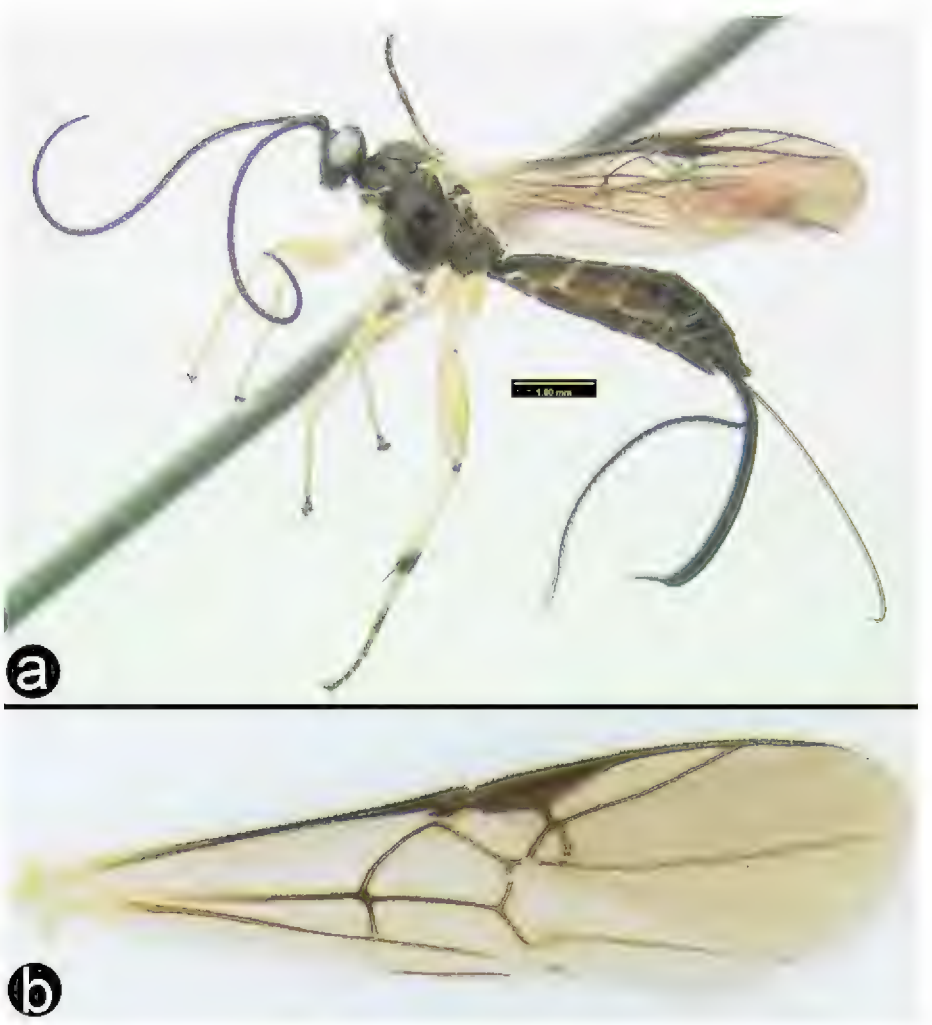


Figure 50. *Earinus aurantius* **a** lateral habitus **b** fore wing.

***Gyrochus yunnanensis* Wang**
http://species-id.net/wiki/Gyrochus_yunnanensis
Fig. 51

Gyrochus yunnanensis Wang 1984 [IZCAS] China.

Diagnosis. The light color of the metasoma combined with the color pattern of the wings is sufficient to distinguish this species. *Gyrochus nigripennis* Enderlein 1920 and *G. sumatransis* Enderlein 1920, both from Indonesia (Sumatra), are similar and differ in the presence of more extensive melanic color especially on the metasoma. *Gyrochus ornatipennis* (Cameron 1905) (New Combination for *Disophrys ornatipennis* Cameron 1905), from Borneo also has more melanic color. *Gyrochus flavipennis* (Brullé 1846) (New Combination for *Agathis flavipennis* Brullé 1846), from Papua New Guinea, has fore wings that are completely yellow.

Gyrochus helvus Enderlein 1920, from Sumatra, has a similar pale body but the fore wing is completely yellow except some very weak infuscation restricted to the apex. *Gyrochus guangensis* Wang, from China also has the fore wing completely yellow.

Notes. The five nominal species of *Gyrochus* differ almost exclusively in color pattern, particularly in the wings. Van Achterberg and Long (2010) illustrated a specimen from Vietnam with much darker wings than that of the holotype; however they have

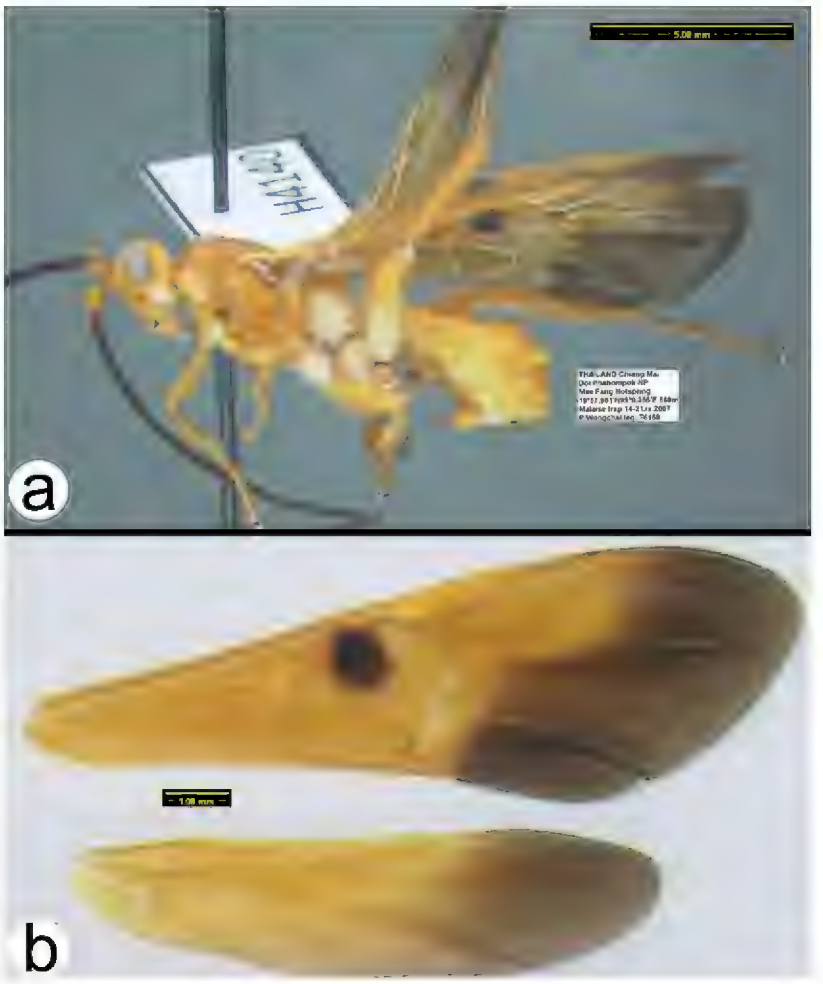


Figure 51. *Gyrochus yunnanensis* **a** lateral habitus **b** wings.

correctly identified the specimen. The specimen illustrated here from Thailand conforms much more closely to the coloration of the holotype.

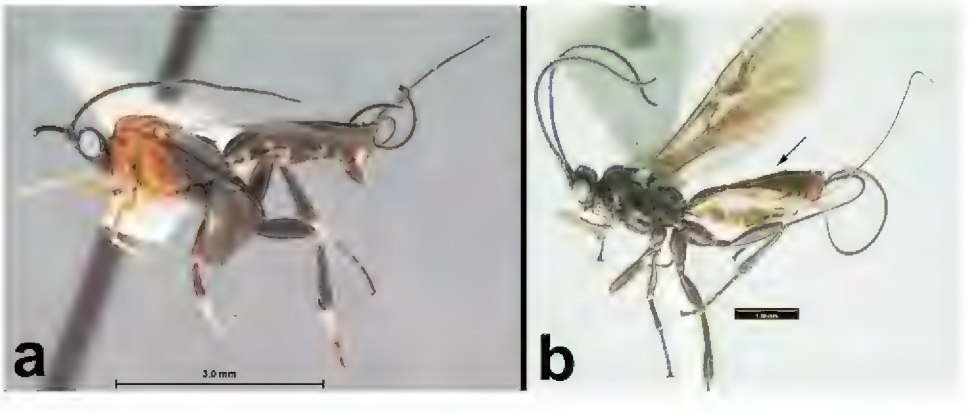
GenBank accession. *H543:* # HQ667973

Distribution. China (Yunnan), Vietnam, Thailand. Distribution map of the Thai specimens which are deposited in HIC and QSBG can be found at http://purl.org/thaimaps/yunnanensis.

Key to species of Thai *Lytopylus*

1a Pro and mesothorax orange, mid and hind basitarsomeres milky white..... ..... ***L. ebulus*** **(Nixon)**

1b Pro and mesothorax mostly or entirely melanic, mid and hind basitarsomeres mostly melanic.....***L. romani*** **(Shestakov)**



***Lytopylus ebulus* (Nixon), stat. n.**
http://species-id.net/wiki/Lytophylus_ebulus
Fig. 52

Agathis ebula Nixon 1950. [BMNH, type examined]
Previously synonymized under *Lytopylus romani* by Sharkey (1998).
Agathis burmensis Bhat & Gupta, 1977. syn. n.

Diagnosis. The orange pro- and mesothorax combined with milky white mid and hind basitarsomeres distinguish this species.

Notes. Here we synonymize *Agathis burmensis* Bhat and Gupta (1997). It differs from the holotype of *Lytopylus ebulus* only in minor color variation and the degree of sculpture on metasomal tergum three, which is somewhat reduced in *A. burmensis.*

Distribution. Examined specimens are from India, Taiwan, Burma, and Thailand. The pale specimen figured in van Achterberg and Long (2010, Fig. 217) identified as *L. romani* appears to be a representative of this species. Distribution map of the Thai specimens which are deposited in QSBG can be found on http://purl.org/thaimaps/ebulus.

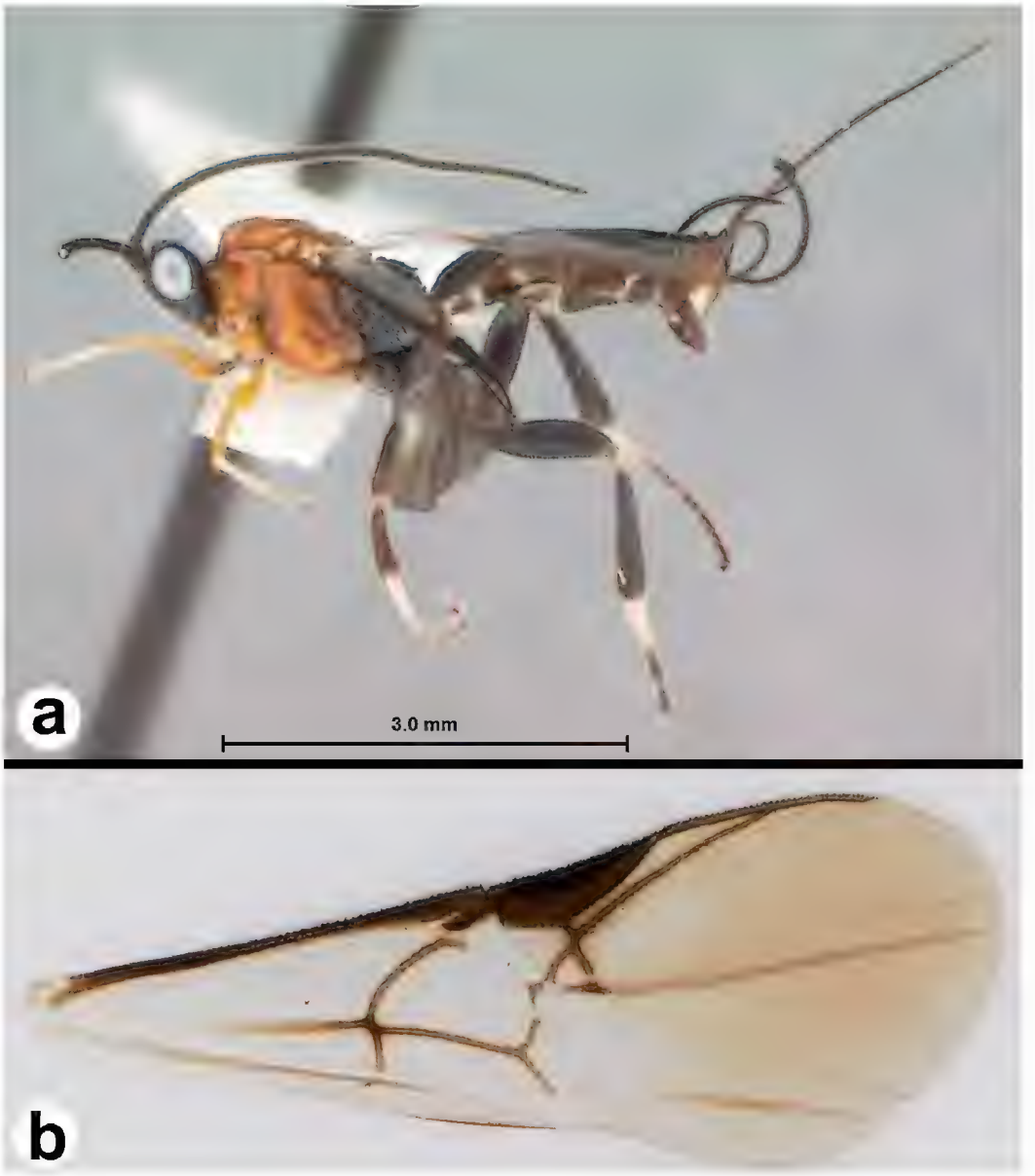


Figure 52. *Lytopylus ebulus* **a** lateral habitus **b** fore wing.

***Lytopylus romani* (Shestakov)**
http://species-id.net/wiki/Lytopylus_romani
Fig. 53

Microdus romani Shestakov1940. [NHRS examined]
Bassus ater Chou & Sharkey1989 (synonymized by Sharkey 1998)

Diagnosis. The melanic mesothorax combined with melanic mid and hind basitarsomeres distinguish this species in this geographic area.

Notes. *Lytopylus romani* may be an uncommonly widespread and variable species or it may represent a complex of species. We suspect that the latter is more likely. The length of the ovipositor varies considerably within the "species" with some specimens from Far East Russia possessing particularly long ovipositors. A molecular approach may be necessary to resolve species limits.

Distribution. Taiwan, India, Japan, Korea, Russia, Far East Russia, Thailand. Distribution map of the Thai specimens which are deposited in QSBG can be found at http://purl.org/thaimaps/romani.

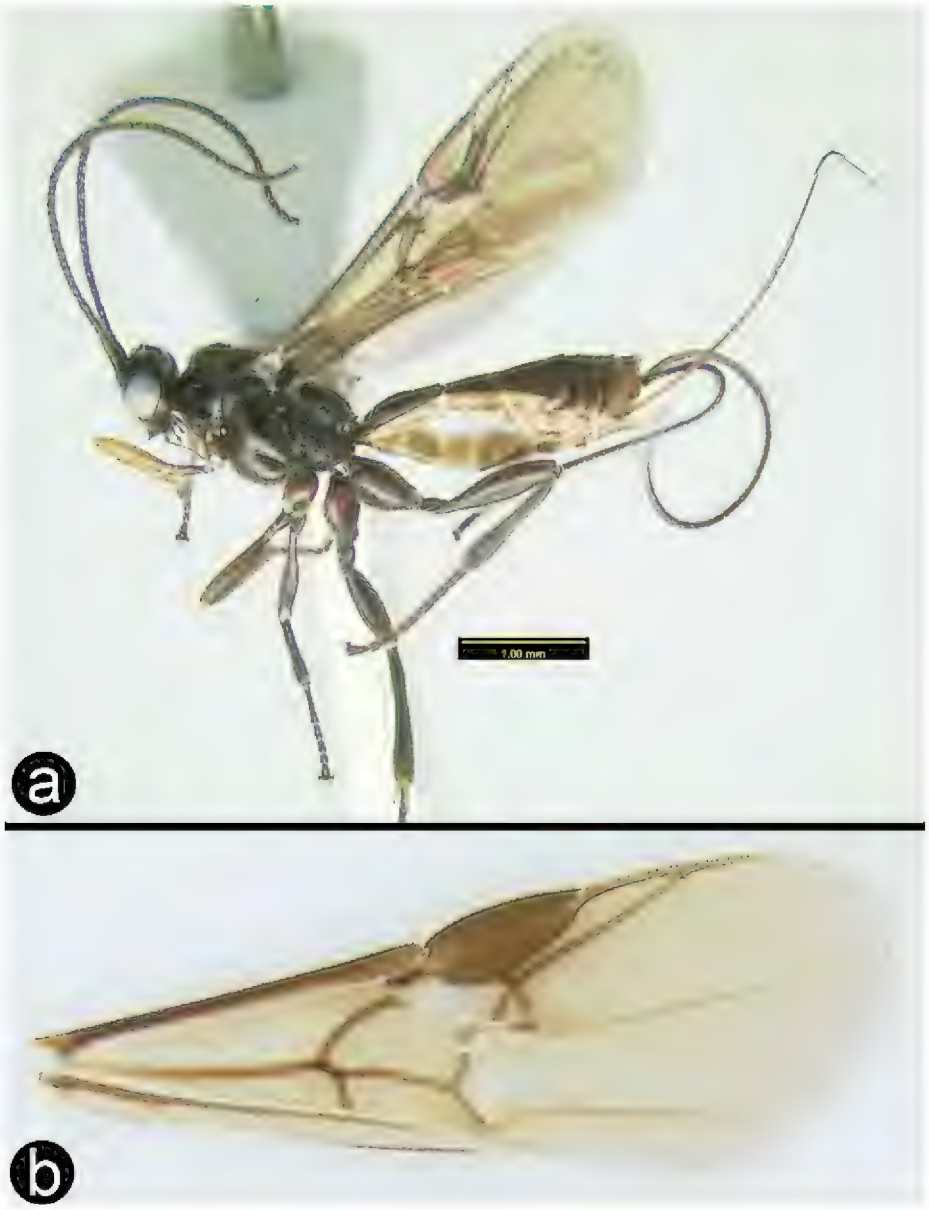


Figure 53. *Lytopylus romani* **a** lateral habitus **b** fore wing.

***Troticus alloflavus* van Achterberg & Long**
http://species-id.net/wiki/Troticus_alloflavus
Fig. 54

Troticus alloflavus van Achterberg and Long 2010 [RMNH, type examined] Vietnam

Diagnosis. There is one other Oriental species. *Troticus giganteus* van Achterberg and Long (2010), has much more extensive melanic color on the fore wing. It is illustrated and described in van Achterberg and Long (2010).

Distribution. Thailand and Vietnam. Distribution map of the sole Thai specimen can be found at http://purl.org/thaimaps/alloflavus.

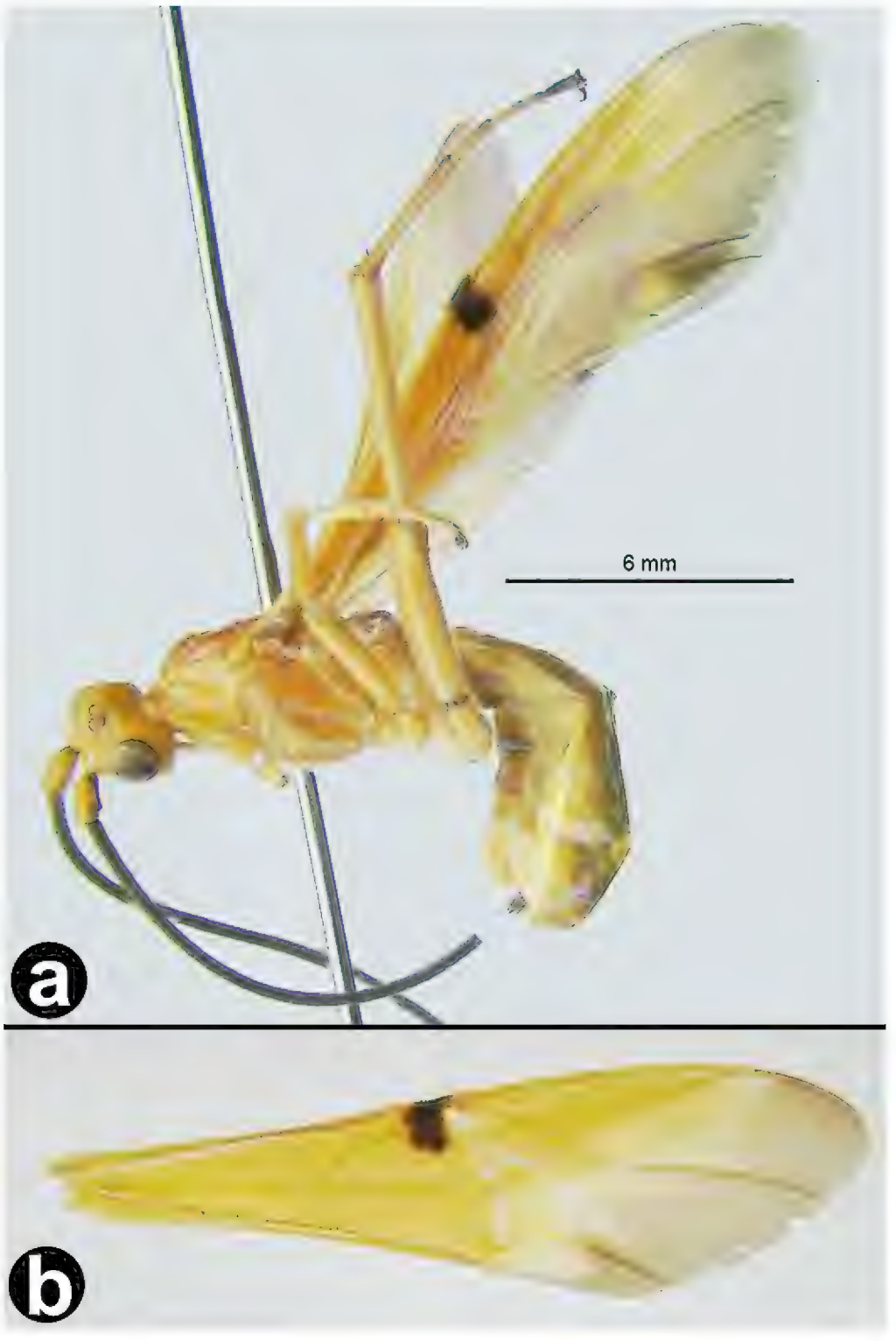


Figure 54. *Troticus alloflavus* **a** lateral habitus **b** fore wing.

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Appendix 1

DELTA data matrix, images, and other files to the key of the Oriental genera of Agathidinae (Hymenoptera, Braconidae). (doi: 10.3897/JHR.22.1299.app1)

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Appendix 2

Interactive key, in IntKey format, to the genera of Oriental Agathidinae (Hymenoptera, Braconidae). (doi: 10.3897/JHR.22.1299.app2)

Note: To run the identification key, you will need Windows 95/NT or a later version. You also need to download Intkey software and reboot your computer, if it is not already installed. The software package, Intkey, can be downloaded from http://delta-intkey.com/www/programs.htm. Once Intkey is installed you need only click on the .ink file (below) and the key will open. Click on any character on the left to begin.

More details on how to use Intkey efficiently are found at http://florabase.calm.wa.gov.au/help/keys/intkey_tutorial.pdf.

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